

EXPLORING THE GUNNISON CANYON, By A. L. FELLOWS

Vol. IX—No. 11

NOVEMBER, 1903

\$1.00 a Year; 10 cts. a Copy

# FORESTRY & IRRIGATION



Published Monthly at Atlantic Bldg., Washington, D. C.

THE FORESTS OF PORTO RICO, By DR. JOHN GIFFORD

**JUDD & DETWEILER**  
**PRINTERS**  
**420-2 ELEVENTH ST.**

*We Print This Magazine*

**WASHINGTON, D. C.**

# **BIXLER'S PHYSICAL** *Training in Writing*

For home instruction and complete mastery of the pen; a book for all the people all the time, in all vocations. 60 pp. illustrated. Price  
**Prof. G. BIXLER, Cor.** Ogden Ave. & Madison St., Chicago, Ill. **\$1.00**

GOOD WRITING, the vehicle of thoughts, the one quality carrying all others, the key to success, the skill that reveals itself in a stroke of the pen. Quickly learned under Bixler's healthy physical culture. at your home.—3 months' mail course included in price of book, for short time only. In use 20 years, and 10s of 1000ds sold. Proved supreme over all others. Valuable prizes for best improvement, best thoughts on writing, etc. Big money selling this book. J. S. Lilly, Hominy Falls, W. Va., learned from it and sold it for 15 years. Just ordered 105 copies. Send \$1, or 2 cents for BUSINESS PENMAN.

## **SUNSET MAGAZINE**

It pictures the Wonders and Special Resources of the West, and its pages give advertisers opportunities offered by no other publication of similar character. Especially in illustrations is the magazine noteworthy. Upon every page are artistic halftone engravings. Subscription **\$1.00 a Year**; for sale by all newsdealers. Published monthly by the Passenger Department of

**Southern Pacific Company**

4 Montgomery St., San Francisco, California

## **If You are a Hunter . . .**

of big game, or an angler,  
 you should subscribe to

## **Rod and Gun in Canada**

Sample Copy sent on  
 application to . . .

**W. J. TAYLOR**

603 Craig Street

**MONTREAL, P. Q.**

In writing advertisers kindly mention FORESTRY AND IRRIGATION.

# SCHOOLS & COLLEGES

## Harvard University



### The Lawrence Scientific School

Announces the establishment  
of four-years' programme of  
courses in

### Forestry

leading to the degree of S. B.  
Instruction in this programme  
will be offered in 1903-'04. . .

Information about require-  
ments for admission, courses  
of study, expenses, etc., may  
be obtained by addressing

**J. L. LOVE, Secretary**

16 University Hall, Cambridge, Mass.

**N. S. SHALER, Dean**

#### HARVARD UNIVERSITY

#### THE LAWRENCE SCIENTIFIC SCHOOL

offers professional courses in Engineering, Min-  
ing and Metallurgy, Architecture, Landscape  
Architecture, Chemistry, Geology, Biology,  
Anatomy and Hygiene (preparation for medical  
schools), Science for Teachers, and a course in  
General Science. Students are admitted to reg-  
ular standing by examination and by transfer  
from other Schools or Colleges. Approved  
Special Students may be admitted without ex-  
aminations. New and enlarged equipment in  
all departments. The Catalogue and special  
circulars will be sent on application to the Sec-  
retary, J. L. Love, 16 University Hall, Cambridge,  
Mass.

N. S. SHALER, Dean.

California, Alta, Placer County

### AGASSIZ HALL

is a boys' Preparatory School in the Sierra Ne-  
vada Mountains. Its boys are encouraged to  
hike, row, swim, fish, hunt, trap, snowshoe as  
out-of-school aids toward developing healthy  
manhood.

... THE ...

## University of the South

Sewanee, Tennessee



#### DEPARTMENTS

ACADEMIC	MEDICAL
THEOLOGICAL	PHARMACEUTICAL
LAW	PREPARATORY



The University of the South is situated in the  
center of its woodland domain of 10,000 acres,  
on the summit of the Cumberland Mountains,  
2,000 feet above sea level.

Open from March to December, the academic  
year being divided into three terms. Students  
from other Universities may attend the sum-  
mer session, July 3 to September 26, in any  
department.

The University domain is being lumbered in a  
scientific manner under the direction of the  
Bureau of Forestry, U. S. Department of Agri-  
culture, and an unusual opportunity is afforded  
for the preliminary study of forestry. Sewanee  
presents an exceptionally attractive field for  
the study of geology, and forest and field  
botany.

For further information address

**THE VICE-CHANCELLOR**

## PRINCIPLES

OF

## AMERICAN FORESTRY

BY

**SAMUEL B. GREEN**

Professor of Horticulture and For-  
estry, University of Minnesota;

Member of the Forest Reserve Board  
of the State of Minnesota.

For the student and general reader—  
elementary, yet complete.

Well illustrated, 12mo., 350 pages.

Cloth, \$1.50.

PUBLISHED BY

**JOHN WILEY & SONS**

43 and 45 East 19th Street  
New York City

In writing advertisers kindly mention FORESTRY AND IRRIGATION

Full of information about Moose, Elk and Deer Hunting and Good Stories. If your newsdealer is out, send 15c. in stamps to us for a copy.

**BIG GAME  
NUMBER  
(For Oct.)**

For 1903 and 1904. An invaluable reference work for all sportsmen. For sale by all newsdealers or in stamps. *Field and Stream* for 15c. in stamps.

**SPORTSMAN'S GUIDE  
AND GAME LAWS**

# YOU SHOULD SUBSCRIBE TO FIELD AND STREAM.

AMERICA'S ILLUSTRATED MAGAZINE FOR SPORTSMEN BY SPORTSMEN.

Subscription Price \$1.50 per year, 15 cents a copy, of all Newsdealers.

A yearly volume makes a priceless collection of the choicest illustrations and literature possible for sportsmen to obtain. Full of valuable information and reliable accounts of exploration in new sections. A broad gauge, literary, authoritative publication for *real sportsmen and sportswomen*.



**HARRY V. RADFORD**  
Editor of *FIELD AND STREAM*'s Adirondack Department.

## Do You Know

THAT

**Harry V. Radford**

"the 'Adirondack' Murray of to-day," has for years conducted a special

### ADIRONDACK DEPARTMENT

in *FIELD AND STREAM*, and that his regular monthly writings in this magazine are among the most novel, interesting, instructive and forceful contributions to the American periodical literature of sport?

As a journalist, Mr. Radford is by all odds the most active, authoritative and widely known exponent of the Adirondacks in America to-day, and his fearless, aggressive and untiring championship of the forests and game of this region is familiar to its friends in every corner of the continent.

His Department in *FIELD AND STREAM* is read and admired by many thousands of Adirondackers throughout America.

**You should read it**

### SOME OF THE FEATURES

which make "*FIELD AND STREAM*" the most popular magazine of its kind, worth many times the subscription price, are: Finely illustrated stories by practical writers; How, When, and Where to go Shooting and Fishing; Game, Fish and Forest Preservation; Popular Natural History; Kennel Department; Photography, E. c., Etc.

### OUR UNPARALLELED SUBSCRIPTION OFFER.

With each year's subscription (\$1.50) we send postage paid a *free* choice of six large pictures of hunting and fishing scenes by distinguished artists (size 19 x 25). These pictures are worthy of a good frame. They are better subjects than can be purchased in the art stores. State whether you desire a trout, bass, dog, moose, ducking or Indian picture. With a five years' subscription (\$7.50) we will send the entire set of six pictures.

ADDRESS THE PUBLISHERS:

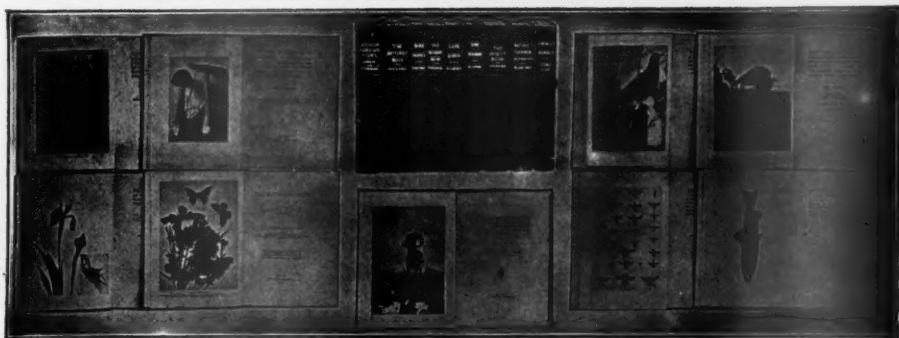
**John P. Burkhard Corporation, 35 West 21st St., New York.**

Mention this publication.

**OUR SPECIAL  
\$2 OFFER !!!**

For Two Dollars and this coupon we will send you *Field and Stream* for a year and a pair of new and original "Hit and Miss" duck shooting pictures in *water color*, worth Six Dollars in any art store—*catchy hits* and worthy of the choicest place in your den.





## The New Nature Library

Nine Superb Large Volumes Containing

American Animals  
Food and Game Fishes  
Bird Neighbors  
Birds that Hunt (Game Birds)  
Nature's Garden (Wild Flowers)  
Bird Homes  
The Mushroom Book  
The Butterfly Book  
The Insect Book

3400 pages, 10 $\frac{1}{4}$  x 7 $\frac{1}{4}$  inches  
250 plates in full color, photographed from the birds, insects, flowers, fish, and mammals themselves  
400 half-tones (remarkable photographs from life) and  
1200 text cuts

with a year's subscription to the unique and beautiful Magazine

## Country Life in America

For

**\$1.00**  
down  
and

small monthly  
payments

"I consider this the best investment in books that I have ever made."  
— Marcus S. Farr (Sc. D.), *Princeton University*.

"The most charming set of books I have in my library."—E. A. Bazette-Jones, *Rector, Church of the Advent, Nashville, Tenn.*

This is the only up-to-date set of books in existence which will give the beginner an immediate acquaintance with the wild life of plants, birds, insects, fish, and mammals, which offers such a fascinating study. The possession of these books will double the pleasure you get out of the country; they are a sort of inspired guide-book to nature made possible only by the researches of earnest nature-lovers and students and by the amazing development of the modern camera.

### How to Get the Set

We now offer a year's subscription to our new magazine, *COUNTRY LIFE IN AMERICA*, together with the new *Nature Library*, (nine octavo volumes, bound in library buckram with leather title label and gilt top), for only \$1.00 with the order and \$2.00 per month for 12 $\frac{1}{2}$  months, or \$26.00 cash with order. Mail this coupon to us with only one dollar, and we will send prepaid the nine books, and enter your subscription to *COUNTRY LIFE IN AMERICA*. If, upon examination, you are not satisfied with the volumes, send them back by express, collect, and your payment will be refunded. If you are satisfied, complete your payment by sending us \$2.00 a month for 12 $\frac{1}{2}$  months, making the total amount \$26.00. (Or send us \$26.00 at once, which will be accepted as full payment.)

*COUNTRY LIFE IN AMERICA* is a monthly magazine, of which L. H. Bailey is editor, devoted to everything connected with the country and outdoor life. It is the most beautiful magazine published.

F. I. Whitney, G. P. & T. A., Great Northern Railway, says:

"There has been no number but what has been worthy of the attention and admiration of any person. I wish to congratulate you, and believe that 'Country Life' is destined to be the greatest magazine of America."

**DOUBLEDAY, PAGE & CO., Publishers**

34 Union Square, East, New York

I accept your offer of the New Nature Library in 9 volumes and *COUNTRY LIFE IN AMERICA* for one year. Enclosed find \$1.00 for first payment, \$2.00 to be remitted by me for 12 $\frac{1}{2}$  months, \$26 in all (or \$26.00 cash with order).

Name.....  
Address.....  
Foreign and  
Irregular.....

THE

National

Irrigation

Association

Chicago,  
1707 Fisher Building.

New York,  
17 Battery Place.

Washington,  
5 and 6 Glover Building.

---

OFFICERS.

THOS. F. WALSH, Washington,  
*President.*

GEORGE H. MAXWELL, Chicago,  
*Executive Chairman.*

JAMES H. ECKELS, Chicago,  
*Treasurer.*

CHARLES B. BOOTHE, New York,  
*Chairman Executive Council.*

GUY E. MITCHELL, Washington,  
*Secretary.*

---

The objects of the Association, as set forth in its Constitution, are as follows:

1. The adoption by the Federal Government of a permanent policy for the reclamation and settlement of the public domain, under which all the remaining public lands shall be held and administered as a trust for the benefit of the whole people of the United States, and no grants of the title to any of the public lands shall ever hereafter be made to any but actual settlers and homebuilders on the land.
2. The preservation and development of our national resources by the construction of storage reservoirs by the Federal Government for flood protection, and to save for use in aid of navigation and irrigation the flood waters which now run to waste and cause overflow and destruction.
3. The construction by the Federal Government of storage reservoirs and irrigation works wherever necessary to furnish water for the reclamation and settlement of the arid public lands.
4. The preservation of the forests and reforestation of denuded forest areas as sources of water supply, the conservation of existing supplies by approved methods of irrigation and distribution, and the increase of the water resources of the arid region by the investigation and development of underground supplies.
5. The adoption of a harmonious system of irrigation laws in all the arid and semi-arid states and territories under which the right to the use of water for irrigation shall vest in the user and become appurtenant to the land irrigated, and beneficial use be the basis and the measure and limit of the right.
6. The holding of an annual Irrigation Congress, and the dissemination by public meetings and through the press of information regarding irrigation, and the reclamation and settlement of the arid public domain, and the possibilities of better agriculture through irrigation and intensive farming, and the need for agricultural education and training, and the creation of rural homes as national safeguards, and the encouragement of rural settlement as a remedy for the social and political evils threatened by the congestion of population in large cities.

# AMERICAN WOODS

By **ROMEYN B. HOUGH, B. A.**

A publication unique in its illustrations, in that they are actual specimens instead of pictures, giving literally "sermons in trees"



A VOLUME OF "AMERICAN WOODS" DISPLAYED

**E**ACH page contains three paper-thin sections of actual wood—transverse, radial, and tangential—and as these are nearly transparent, they show clearly the structure. They are mounted on strong bristol board, which bears the accurate scientific and popular names of each specimen shown, together with the common name in German, French, and Spanish.

Invaluable for  
**BOTANISTS**  
**WOODWORKERS**  
**LUMBERMEN**  
**FORESTERS**  
**ARCHITECTS**  
**BUILDERS**

The pages on which the specimens of wood are mounted are separate, to facilitate examination and comparison one with another, and in order that they may be used in direct connection with the text which accompanies each volume.

Of great use to  
**SCHOOLS**  
**COLLEGES**  
**MUSEUMS**  
**LIBRARIES and**  
**PRIVATE**  
**COLLECTIONS**

Nine parts of this great work have been issued, and are ready for delivery; others will follow at the rate of one or two parts per year. Each part contains at least three specimens each of 25 species, with illustrated text.

*The following are the net prices per part:*

Green or brown cloth, imitation morocco, \$5.00. Half-morocco, \$7.50.

Address:

**FORESTRY AND IRRIGATION**

**Atlantic Building, Washington, D. C.**

In writing advertisers kindly mention **FORESTRY AND IRRIGATION**

# THE AMERICAN SPORTSMAN'S LIBRARY

Under General Editorship of **Caspar Whitney**

*The Only Library of Sports Adapted to the American Reader  
Complete in 20 volumes, at \$2 net per volume*

A partial list of Contributors includes

**Theodore Roosevelt, Dean Sage, Edwyn Sandys, Charles F. Holder, F. S. Van Dyke, L. C. Sanford, James A. Henshall, Owen Wister.**

The volumes are illustrated by such artists as

**A. B. Frost, Carl Rungius, L. A. Fuertes, Charles L. Bull, Martin Justice, C. F. W. Mielatz, and Tappan Adney.**

Published in two series of 10 volumes each, all uniform, the whole set is a remarkable epitome of outdoor life, dealt with authoritatively, yet in simple and untechnical language, and in each volume will be found much to interest and instruct the general reader.

## Of the FIRST SERIES, those NOW READY are:

### The Deer Family

By THEODORE ROOSEVELT and others. Illustrated by Carl Rungius, with maps by Dr. C. Hart Merriam.

### Salmon and Trout

By Dean Sage, W. C. Harris, and H. C. Townsend. Illustrated by A. B. Frost and others.

### Upland Game Birds

By Edwyn Sandys and T. S. Van Dyke. Illustrated by L. A. Fuertes, A. B. Frost, C. L. Bull, and others.

### The Water-Fowl Family

By L. C. Sanford, L. B. Bishop, and T. S. Van Dyke. Illustrated by A. B. Frost, L. A. Fuertes, and C. L. Bull.

### Bass, Pike, Perch, and Others

By James A. Henshall, M. D. Illustrated by Martin Justice and Charles F. W. Mielatz.

### The Big Game Fishes of the United States

By Charles F. Holder. Illustrated by Chas. F. W. Mielatz and others.

## TO BE READY IN THE FALL

### The Bison, Musk Ox, Sheep, and Goat Family

By George Bird Grinnell, Owen Wister, and Caspar Whitney. Illustrated by Carl Rungius and others.

### Cougar, Wild Cat, Wolf, and Fox

With many illustrations.

### The Bear Family

By Dr. C. Hart Merriam. Illustrated by Carl Rungius and C. L. Bull.

### Guns, Ammunition, and Tackle

By A. W. Money and others. Illustrated.

## SECOND SERIES—In preparation

### Photography for the Sportsman Naturalist

### The Sporting Dog

### The American Race Horse, The Running Horse

### Trotting and Pacing

### Riding and Driving

### Baseball and Football

### Yachting, Small Boat Sailing, and Canoeing

### Rowing, Track Athletics, and Swimming

### Lacrosse, Lawn Tennis, Boxing, Wrestling, Etc.

### Skating, Hockey, Ice Yachting, Coasting, Etc.

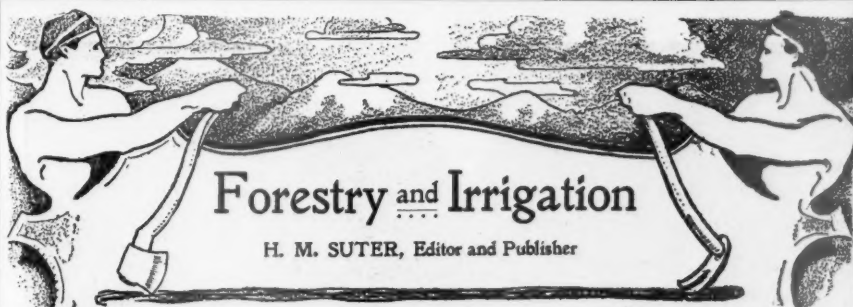
## SPECIAL OFFER

This exceedingly interesting and valuable series will be offered for a limited period upon very liberal terms. Send \$4.00 with coupon cut from this magazine and \$1 per month for 36 months thereafter, and we will send you free of all charges the volumes now ready, and the others as they are issued. The books are good to look at, being tastefully bound in dark green cloth, with gold ornaments and lettering and gilt top.

**The MACMILLAN COMPANY**

66 Fifth Ave., New York

I accept your offer of THE AMERICAN SPORTSMAN'S LIBRARY in 20 volumes.  
payment, \$1.00 each month to be remitted by me for 36 months.  
Name .....  
Address .....  
F & I



## CONTENTS FOR NOVEMBER, 1903

THE GRAND CANYON OF THE GUNNISON RIVER . . . . . *Frontispiece*  
 NEWS AND NOTES (*Illustrated*)

Notice of Annual Meeting . . . . .	517	Scene in Virgin River Valley, Utah . . . . .	521
Change of Address . . . . .	517	Some Inconsistent Statesmen . . . . .	522
New York Campaign . . . . .	517	A Right Land Law . . . . .	522
Special Articles . . . . .	517	The Inconsistency . . . . .	522
Appalachian Forest Reserve . . . . .	518	Balsam Instead of Spruce . . . . .	523
Yale School Continues to Grow . . . . .	518	American Scientists Wanted . . . . .	524
University of Michigan . . . . .	519	Irrigation Litigation . . . . .	524
The Biltmore School . . . . .	519	Minnesota Logging Rules . . . . .	525
University of Nebraska . . . . .	519	Irrigation Projects in New Mexico . . . . .	526
Michigan Agricultural College . . . . .	520	A Sanctimonious Swindle . . . . .	526
Irrigation on a Large Scale . . . . .	520	Irrigation Work in North Dakota . . . . .	527
The Hydrographic Conference . . . . .	520	Irrigation in Sacramento Valley . . . . .	528
Radical Forest Preservation . . . . .	521		

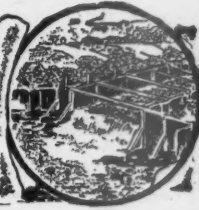
OVERTON W. PRICE ( <i>with portrait</i> ) . . . . .	529
THE GUNNISON TUNNEL ( <i>Illustrated</i> ) . . . . .	A. L. Fellows 530
THE LUQUILLO FOREST RESERVE, PORTO RICO ( <i>Illustrated</i> ) . . . . .	Dr. John Gifford 537
THE IRRIGATION LAWS OF NEVADA . . . . .	A. E. Chandler 541
FORESTRY AT BILTMORE ( <i>Illustrated</i> ) . . . . .	Dr. C. A. Schenck 543
CRANBERRY CULTURE ( <i>Illustrated</i> ) . . . . .	Bristow Adams 547
COURSES IN FORESTRY AT AGRICULTURAL COLLEGES . . . . .	Samuel B. Green 552
AN INTERESTING PHASE OF GERMAN FORESTRY . . . . .	Austin Cary 554
FLOOD PREVENTION IN INDIANA . . . . .	C. J. Blanchard 556
DEFEATING THE HOMESTEAD IDEA . . . . .	William E. Smythe 557
OWENS RIVER VALLEY . . . . .	558
RECENT PUBLICATIONS . . . . .	559

FORESTRY AND IRRIGATION is the official organ of the American Forestry Association and The National Irrigation Association. Subscription price \$1.00 a year; single copies 10 cents. Copyright, 1903, by H. M. Suter. Entered at the Post Office at Washington, D. C., as second-class mail matter.

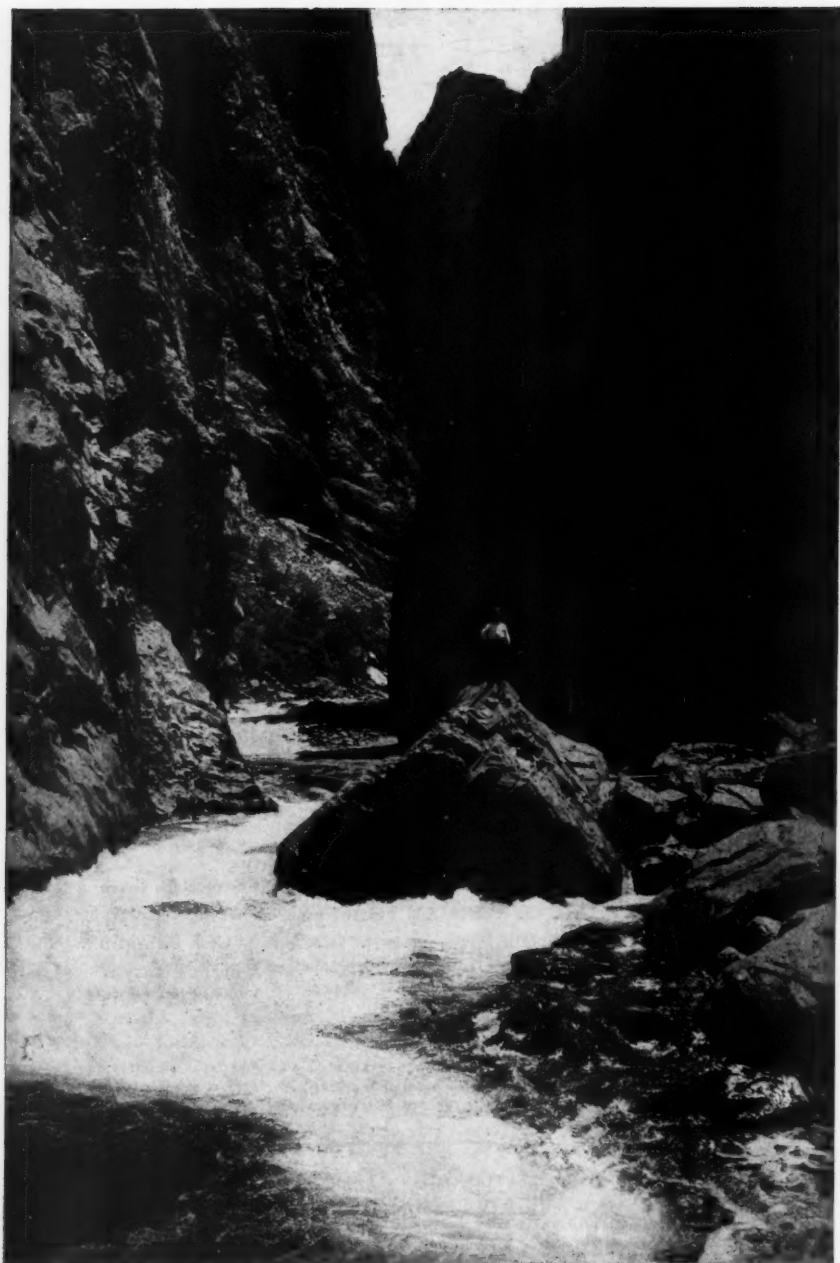


Published Monthly at  
 ATLANTIC BUILDING

Washington, D. C.







VIEW OF THE GRAND CANYON OF THE GUNNISON RIVER, COLORADO, AT THE POINT WHERE  
THE GUNNISON TUNNEL IS TO BE LOCATED.

# Forestry and Irrigation.

VOL. IX.

NOVEMBER, 1903.

NO. 11.

## NEWS AND NOTES.

### Notice of Annual Meeting.

Under the terms of Article XI of the By-laws of The American Forestry Association, the 22d annual meeting of The American Forestry Association will be held at the Bureau of Forestry, Atlantic Building, Washington, D. C., on Wednesday, December 9, at 10 a. m. The business to come before the meeting consists of the election of officers for the ensuing year, the presentation and consideration of the annual reports of the directors, secretary, and treasurer, with any other matters properly to be considered at such annual meeting.

EDW. A. BOWERS,  
*Secretary.*

### Change of Address.

Mr. Otto Luebker, treasurer of the American Forestry Association, who for thirteen years past has been in the government forest service, has resigned from the Bureau of Forestry to engage in private business pursuits. Members of the association will note that his present address is the Colorado Building, Washington, D. C., instead of the Atlantic Building, as heretofore.

### New York Campaign.

The National Irrigation Association has opened permanent headquarters in New York at 17 Battery Place, with Hon. C. B. Boothe, chairman of the Executive Council of the Association, in charge. A vigorous campaign to interest the business men of New York in national irrigation will now be carried on. The National Irrigation Association already has about four hundred members in New York among

the public-spirited men of the city. Mr. Boothe spent a short time there last spring making preliminary arrangements for beginning this work, and he was given a most cordial reception by many leading business men. He has wide experience in national irrigation work, having for some time been chairman of the southern California section, which numbers several hundred of the most substantial men of affairs of that section.

### Special Articles.

In this number of FORESTRY AND IRRIGATION there are several special articles of general interest on timely subjects. The Gunnison Tunnel, one of the most important of the irrigation projects undertaken by the federal government, both from an engineering standpoint and for the benefits expected from its completion, is described by A. L. Fellows, the engineer in charge. The survey of the proposed tunnel and dam site was an extremely hazardous piece of work, which Mr. Fellows modestly minimizes in his account of it. A. E. Chandler, state engineer of Nevada, in discussing the irrigation laws of his state, points out the value of a recent law which is the medium of hearty coöperation between the state and federal governments in developing the water resources of Nevada. It is a law that could be copied to advantage in every state in the West. "Forestry at Biltmore," by Dr. Schenck, and "Courses in Forestry at Agricultural Colleges," by Professor Green, are from the list of papers read at the Minneapolis meeting of the American Forestry Association, which are being printed as rapidly as space will permit.

### Appalachian Forest Reserve.

Congress is again in session, and this brings to mind the necessity for the friends of the proposed Appalachian Forest Reserve getting down to work. Further argument regarding the need for this reserve, and that it is a national affair, is not needed. President McKinley regarded it with favor and sent a special message to Congress asking its consideration; President Roosevelt has given ample testimony of his great interest in the project, and his assistance can be counted on. On June 24, 1902, the Senate passed a bill establishing this reserve, but owing to lack of time it was not considered in the House. At last winter's session the Senate again passed a bill creating the reserve, but consideration of it was blocked in the House, where it would have undoubtedly passed by a large majority if it had been brought to a vote.

The country is in favor of establishing the Appalachian Forest Reserve, and Congress will act just as soon as it hears from the people. See to it that your Congressman learns of your wishes in the matter. The long session following the extra one now in progress offers enough time to bring the bill to a vote. Action is the word for all persons interested.

### Yale School Continues to Grow.

Reports from the forest schools show a decided increase in attendance. The registration of the Yale Forest School this year is 66. Half of this number are classed as Seniors and the other half as Juniors. This is an increase of 26 over the registration of last year.

A number of changes and additions have been made to the teaching force. Professor Graves, of course, retains his position as Professor of Forestry and director of the school. Last spring Professor Toumey was appointed a full Professor of Forestry instead of Assistant Professor of Forestry. Mr. Pinchot, Chief of the Bureau of Forestry, was also appointed a full Professor of Forestry. Walter Mulford, State Forester

of Connecticut, has been appointed Assistant in Forestry during a portion of the year. Mr. Arthur H. Graves, formerly Assistant in Botany in the Sheffield Scientific School, has been appointed assistant in Forest Botany in the Forest School. Hence, the teaching force now comprises five men who are devoting their entire time to the school, in addition to the considerable number of instructors and lecturers who will give individual courses.

Mr. Pinchot will give this year a course of twelve lectures on Forest Reserves, and will give a course of six lectures on State and National Forestry, the subject on which he has lectured in previous years. There are no other important changes in the curriculum. The courses are now arranged, however, so that considerably more field work is given than hitherto. The arrangement of the courses for the fall term is as follows:

*Junior Class*—Monday, Field Work in Silviculture, all day.

Tuesday, Section I, Lectures in Silviculture, 9 to 11 a. m.

Lectures in Forest Mensuration, 11.30 to 12.30.

Section II, General Morphology of Plants, 9 to 12 a. m.

Wednesday, Field Work in Forest Mensuration, all day.

Thursday, Section I, Morphology of Plants, 9 to 12 a. m.

Forest Botany, 2 to 5 p. m.

Section II, Lectures in Silviculture, 9 to 11 a. m.

Forest Mensuration, 11.30 to 12.30.

Friday, Geology in Relation to Soils, 10 to 1 a. m.

General Morphology of Plants, 2 to 5 p. m.

Saturday, Forest Botany, Field Work, morning or all day.

*Senior Class*.—Monday, Forest Technology, 2 to 5 p. m.

Tuesday, Lectures in Lumbering, 9 to 11 a. m.

Wednesday, Forest Technology, 2 to 5 p. m.

Friday, Lectures in Forest Management, 9 to 11 a. m.

Lectures in Forest Protection, 11.30 to 12.30.

The days and half days on which there are no definite school appointments are devoted to thesis work and to assigned field work.

### University of Michigan.

The courses in forestry at the University of Michigan, given under the direction of Professors Filibert Roth and Charles A. Davis, are attended during this semester as follows:

Course I. General Course, Professor Roth, 11 students.

Course IIa. Silviculture, Professor Davis, 10 students.

Course IIc. Forest Protection, Professor Davis, 6 students.

Course III. Mensuration and Description, Professor Roth, 9 students.

Course V. Management, Professor Roth, 5 students.

Course VII. Timber Physics, Professor Davis, 6 students.

In all, 25 men are taking the courses in forestry and the preparatory work for forestry at the university. The work has been slightly hampered by failure of needed equipment. An excellent collection of tree sections, a suitable library, and field instruments from the best makers will soon render completely available the instruction which Professor Roth is so well fitted to impart.

### The Biltmore Forest School.

The Biltmore Forest School is attended this year by 20 students, a majority of whom have had a college training and the balance a business training. The entrance requirements have been recently changed to read as follows: "The Biltmore Forest School is open: First. To college graduates. Second. To applicants of good education and thorough business training, over 20 years old, especially to lumbermen and sons of forest owners. Third. To special students, for special lectures, and under special arrangements."

Candidates for admission are required to submit certificates relative to moral character and previous training. An applicant unable to proffer sufficient certificates of educational standing must

prove his qualification by passing entrance examinations.

All strictly forestal lectures are given by Dr. C. A. Schenck. T. F. Pevear (Brown University, 1902) lectures on geology and dendrology to supplement Dr. Schenck's lectures on silviculture; on mathematics to back and aid the work in mensuration, surveying, and forest finance, and on forest economics to back his lectures on forest management and forest policy.

The afternoons are devoted to out-of-door work. Several graduates of the school now have charge of the work conducted on three ranges. Another graduate has charge of the preparation of a working plan for the so-called "Bent Creek Estate." The school, in the course of the winter, will prepare a working plan for the "Busbee Estate."

The equipment consists, in the woods, of steam saw-mills, wood-splitting establishments, planing mills, water mills, a force of 15 rangers, 150 hands, 22 teams, and 12 yoke of oxen, continuously employed. The equipment in the office and school house consists of an excellent forest library and a collection of tools and implements used in lumbering and forestry. All these things offer students at Biltmore an excellent opportunity to become acquainted with the routine work of a large forest administration.

### University of Nebraska.

The prospects of the Department of Forestry in the State University at Lincoln seem decidedly favorable. Twenty students are now taking up the courses in forestry. Some of these men have elected only a part of the work of the department, but the majority have enrolled for the entire course. Three men are expected to complete the course this year.

The Board of Regents has voted a liberal appropriation for the purchase of instruments and other equipment for field and class-room work. The department will also receive a share of the library fund with which to add to the forest library.

A feature of the courses is the work

in timber physics, in charge of the engineering department, which is equipped with a Riehle testing machine for determining the strength of woods used in construction. This new department at Nebraska is under the direction of F. G. Miller, formerly of the Bureau of Forestry.

#### Michigan Agricultural College.

The Department of Forestry in the Michigan Agricultural College at Lansing has started on its second year with very encouraging prospects. Besides the students now in the junior and senior years, a dozen or more of the underclassmen have expressed their intention of taking the work as soon as permitted according to the program. An organization of the students in forestry has been started.

Three students from another state have entered the college this fall for the special purpose of taking the work in forestry there. This may be attributed partly to the absence of a forest school in their own state and partly to the amount of agricultural and practical work in the course and to the low expense. The equipment has been augmented by securing a tool-room and more instruments for mensuration and investigation. Photographs, maps, lantern slides, an herbarium and museum specimens, cabinets, books, and periodicals have also been provided, and the nursery, plantations, and improvement cuttings are under way.

#### Irrigation on a Large Scale.

A recent report of the irrigation committee at Simla, India, contains the information that the government proposes to lay out \$150,000,000 in twenty years in building irrigation works. It further intends to devote \$2,000,000 annually in loans for private irrigation works. The funds necessary to carry out these plans are to be raised by loans and the interest thereon charged to the famine grant. The keynote of the policy of the irrigation committee is the vigorous use of the natural resources of the country for their resisting power in the battles with famine.

#### The Hydrographic Conference.

A conference of eastern hydrographers, called by F. H. Newell, chief engineer of the Hydrographic Division of the Geological Survey, was held in Washington from October 28 to 31, inclusive. The following districts and divisions of the work were represented: New England, N. C. Grover; New York, Robert E. Horton; Central States, E. G. Paul; Southern States, M. R. Hall; Mississippi Valley States, E. Johnson, Jr.; general inspection, E. C. Murphy; Washington office, G. B. Hollister and John C. Hoyt; hydro-economics, M. O. Leighton; hydrology, M. L. Fuller.

At the opening of the session, Director of the Survey Charles D. Walcott and Chief Engineer F. H. Newell gave brief addresses, in which they traced the growth of the hydrographic division from its small beginning to its present position of importance. In the general discussions that followed, the principal details of the work were carefully considered. The conditions in each district were reviewed and compared with those in other sections, and plans were prepared whereby the standard of the work will be still further advanced. Much time was spent in considering the nature of the demands for hydrographic data as made both by the engineering and the general public. Ways and means whereby these demands may best be met were fully discussed, and a special effort will be made to distribute the gaging stations and to adjust the methods and reports so as to best provide for the wants of the largest number.

The determination of the profiles of rivers, which work has just been started, was also discussed. These data are important factors in hydrographic studies, and, to meet the growing demands for them, it is planned to extend the surveys so as to cover the more important rivers.

Plans were made for the preparation of a manual on hydrographic methods. In this publication it is proposed to bring together the best hydrographic methods as developed by the hydrographers of the U. S. Geological Survey and by other engineers. There has been a



large call for this publication, both from the Survey's corps of engineers and from engineers in private life. An effort will be made to fill the needs of both these classes.

One day during the session was spent at the Harrisburg Gaging Station on the Susquehanna River, making experiments to test the relative merits of the principal methods used in current meter measurements.

**Radical Forest Preservation.** The following letter was received recently by the American Forestry Association and shows that the writer is in favor of a very radical policy of forest preservation:

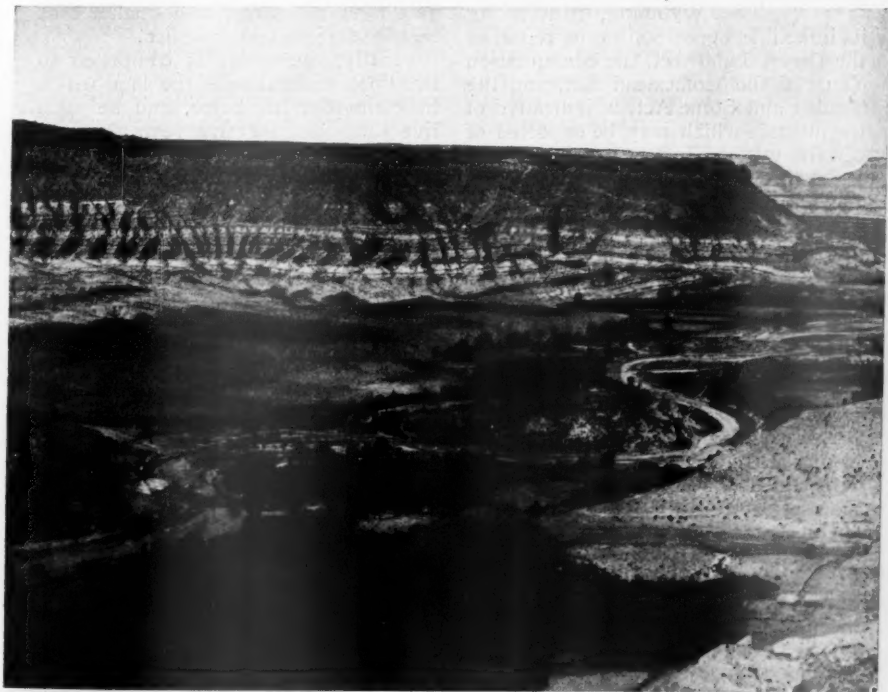
*American Forestry Association.*

HONORABLE AND DEAR SIR: While you are planning for the preservation of the forests, be kind enough to take

into consideration the instructions which the Bible states the first man got about the use of the forest: Genesis, chapter I, v. 29: "And God said, 'Behold, I have given you every herb bearing seed which is upon the face of all the earth, and every tree in which is the fruit of a tree yielding seed. To you it shall be for *meat*.'"

Now that verse, short as it is, covers the whole of the vegetable kingdom; and, putting aside the manner in which God spoke to the man as irrelevant, the man was told, plainly and squarely, that the vegetable matter was to be used for *meat*. He was thus denied the right to make even a war club, or a boat out of wood, or any portion of the vegetable matter, for such things are not *meat*.

And the reason why he was denied the right is plain enough to me. When a tree or any other vegetable form is growing, it is demonstrating the prin-



VIRGIN RIVER VALLEY, UTAH, SHOWING EFFECTS OF IRRIGATION.

ciple of life as truly as man is ; because it is in action, which is *Life*. When it ceases to grow and begins to decay, it is still living ; when it is chopped down and burned it is still living, and when any form of vegetable matter is passing through any animal body it still lives.

But when it is turned into any dead form, like a bedstead, for example, it ceases to live because it becomes inactive and inaction is *Death*.

Hoping you will try to realize that Adam and Eve were not condemned for breaking the ten commandments, but for breaking the natural law, I remain a believer in the preservation of the forest in its truest and highest sense.

JOHN LERRIGAN,  
*Franklin, Pa.*

#### **Some Inconsistent Statesmen.**

The recent action of the Wyoming Industrial Convention at Sheridan, Wyoming, in declaring its inflexible opposition to the repeal of the Desert Land Act, the commutation clause of the Homestead Act, and the Timber and Stone Act, is indicative of the attitude which may be expected of certain western interests on any land legislation hostile to the speculator and the live stock baron.

In the hot debate at the Ogden Irrigation Congress, a few weeks previous, the issue was on the merits of these land laws and the fierce demand for their repeal, which has arisen in various parts of the United States.

Several western Congressmen who participated opposed the repeal of the laws, but at the same time referred with pride to the part they had taken in assisting in the passage of the National Irrigation Act. Not one of these gentlemen seemed to realize the inconsistency involved in opposing the repeal of the Desert Land Law in one breath, and in the next breath gloating over the triumph of national irrigation. What are the facts?

The Desert Land Law permits a single individual to acquire 320 acres of irrigable land. With the assistance of his good wife, the same individual may take up 640 acres. And he need not

live upon the land at all. He can make some little improvement and swear that he has made some sort of arrangement to irrigate it, when he gets title by paying \$1.25 an acre. Under such provisions, it is indeed easy for speculators to obtain land to sell out later to real home-seekers at a big profit or to consolidate into large holdings.

This is the law which the Congressmen referred to insist upon keeping upon the statute books.

#### **A Right Land Law.**

Now, what is done with the lands when the National Irrigation Act is in operation? First, they are absolutely withdrawn from entry while the feasibility of the project is under consideration. Next, the Secretary of the Interior is empowered to fix the amount of land which a single individual may acquire, but is forbidden to fix a larger unit than 160 acres, or a smaller unit than 40 acres in any instance.

Finally, the settler is compelled to live upon and cultivate the land which he claims for his home, and he must live there not for five years, but ten years, which is the period fixed for the repayment of the government's expenditure.

In other words, every claim made by the advocates of the repeal of existing land laws is absolutely conceded in the terms of the National Irrigation Act. So far as the areas to be covered by the new policy are concerned, the Desert Land Law and the commutation clause of the Homestead Law stand repealed, and the nation has thereby declared its uncompromising attitude on the issue debated at Ogden.

#### **The Incon- sistency.**

Now, then, what becomes of the consistency of the aforesaid Congressmen? Are they not standing on both sides of the question at the same time? By voting for the National Irrigation Act they declared that no citizen ought to have more than 160 acres of irrigable land from the public domain, and in some instances he ought

not to have more than 40 acres. Then how can they consistently demand that citizens shall continue to take 320 acres under the Desert Land Law?

By voting for national irrigation they declared that a settler must actually live upon his land ten years before getting title to it. Then how can they consistently demand that men shall obtain title without occupying the land at all, as they are now doing?

A Congressman may consistently claim that the present laws are good, and that the National Irrigation Act is bad. He can claim that the present laws are bad, and that the National Irrigation Act is good; but he cannot maintain the proposition that both are good, because they are diametrically opposed in fundamental respects.

It may be asked, Why repeal present land laws if national irrigation makes the proper provision for safeguarding the people's interests? The answer is that the new policy is only in its experimental stages, and cannot extend over the entire irrigable public domain for many decades. In the meantime speculators are quietly taking the most valuable land and defeating one of the prime objects of the new law.

### **Balsam Instead of Spruce.**

The importance of finding a satisfactory substitute for Spruce for the manufacture of paper

pulp led to a commercial study of the Balsam Fir, which Mr. Raphael G. Zon, of the Bureau of Forestry, has just concluded.

The rapid disappearance of Spruce, the best tree in the north woods for the manufacture of pulp, has forced pulp makers to use more and more Balsam, and has brought that tree, once despised and neglected, into a very important place. Four years ago practically no Balsam was used by pulp manufacturers, many of whom are now using from 25 to 50 per cent of it. The amount of Balsam used depends entirely on the Spruce supply near where the different mills are located. The smaller the amount of Spruce available the greater is the amount of Balsam used.

Pulp manufacturers find Balsam the best substitute for Spruce which can be found in the north woods. Other trees there are which might serve well for paper pulp, but they are not native to the country where the mills are located. Pulp mills are enormously heavy and expensive, and the wood must be brought to them—they can not be taken to the wood. The pulp man, therefore, in his choice of a substitute for his diminishing supply of Spruce, is confined to the very few species that grow in association with Spruce, and of these species Balsam is at once the most abundant and the most promising.

The present method of making pulp out of Balsam is to grind it or treat it with chemicals along with Spruce. The results are not satisfactory. Balsam mixed with Spruce produces an inferior grade of pulp. Mr. Zon suggests that it would be much better if Balsam were handled independently of Spruce. The Balsam fibers are not nearly so tough and strong as those of Spruce, and the pressure of the grinders, which are adjusted for Spruce fibers, is too powerful for the fibers of Balsam, and they are torn and weakened. For the same reason the chemicals used in the treatment of Spruce fibers weaken and dissolve the fibers of Balsam when used in the same strength. Examples of what can be done with Balsam in the manufacture of paper are found in France, where the tree is made to produce good book papers. There not only the main trunk, but even the top of the tree is used.

The silvicultural features of the Balsam are related by Mr. Zon, who has studied the tree carefully throughout its range, but particularly in Maine and the Adirondacks. Spruce has been cut for many years, while Balsam has scarcely been cut at all; hence Balsam has taken the place of and is crowding out the Spruce. This change in species in the north woods is hastened by the great superiority of Balsam as a seed tree, for Balsam bears seeds every year, while the Spruce seeds only once in seven years. These conditions make it apparent how very desirable it is that pulp manufacturers should use Balsam wherever possible, for in doing so they

not only lessen the drain on the limited amount of Spruce left, but they give the tree a chance to grow and reproduce itself. This point Mr. Zon brings out forcefully.

The results of Mr. Zon's work will appear this winter in the form of a bulletin published by the Bureau of Forestry.

### Geological Survey Note.

Reports are being prepared upon the underground waters of the following states: Missouri, Minnesota, Illinois, South Carolina, Tennessee, Iowa, Maine, Vermont, Georgia, Alabama, and northern Michigan. These papers will be published in the general Progress Report to be issued at the beginning of the year.

### Want American Scientists.

Hon. Charles D. Walcott, Director of the Geological Survey, has received a letter from the Peruvian Government, requesting him to detail two engineers to organize and presumably to take charge of investigations in hydrology to be carried on in Peru.

For this work men are needed who combine engineering with geological knowledge, since the investigations will probably be carried on both at the surface and underground.

It is understood that, while no appointments have yet been made, several engineers have the matter under consideration.

### Irrigation and Litigation.

Irrigation in the arid West from its early inception has been synonymous with litigation. No great work of canal construction has been brought to a successful completion without costly and tedious litigation. Few individual efforts at irrigation have escaped the same annoyance. The history of irrigation in most of the Western States is replete with neighborhood brawls and murders. The man behind the gun at

the ditch headgate got the water. His neighbor sought the courts, or the coroner presided at an inquest. The court records are burdened with contests over water rights.

In California reports from 73 irrigators show an expense incurred during 1899 of \$125,000 for court and lawyer fees. Presumably the defendants spent as much more, making a total of a quarter of a million dollars spent in one state in a single year in irrigation litigation. It is notorious in California that few of the decisions were conclusive or gave the victors any sense of security. At a fair estimate, every acre of land irrigated in that state in that year paid a tribute of 30 cents to the courts and lawyers. Assuming that litigation in the other states is not so expensive by one-half as that in California, the irrigation litigation of the arid states in 1899 would still be more than one million dollars, or nearly 16 cents per acre for the 7,000,000 acres irrigated that year.

In the states usually classed as arid the census reports 102,819 irrigated farms, containing a population in excess of half a million. The assessment for litigation was therefore nearly \$10 per farm, or \$2 *per capita* of irrigating farmers. The seven millions of acres were irrigated by canal and ditch systems, which cost approximately \$64,000,000 and produced crops valued at more than \$84,000,000. These figures are a most creditable commentary upon the courage and enterprise of the western farmer. It is regrettable that the annual outlay of large sums in litigation in this same region forbids a like tribute being paid to the statesmanship of the western lawmaker, and emphasizes the urgent need of a careful revision of the present statutes.

At the present time there is a woeful lack of uniformity in the legislative enactments of the several arid states and territories relating to water rights and stream diversion, and the laws of nearly every individual state are imperfect. The need for reformation is imperative, especially since the national government has undertaken the heavy responsibility of constructing and operating enormous

reclamation works, many of which will be interstate in character.

The government engineers have already experienced difficulties in their preliminary work by reason of these conflicting statutes. A committee has been organized in Washington to study the legal questions and to make recommendations to future legislatures when requested by them.

#### Rules for Logging in Minnesota.

The following rules and regulations have been laid down by Gifford Pinchot, Forester of the

U. S. Department of Agriculture, to govern the cutting and removal of timber from the lands to be included in the Minnesota National Forest Reserve. As provided by the Morris Bill, 95 per cent of the pine is to be lumbered from certain ceded lands, comprising parts of the Cass Lake and Chippewa divisions of the Mississippi Indian Reservations in Minnesota and selected for the Minnesota National Forest Reserve.

1. No tree shall be cut that is stamped with the letters "US."

2. No White Pine or Norway (Red) Pine, 10 inches and under in diameter, 3 feet from the ground, shall be cut for any purpose, except where absolutely unavoidable in necessary logging operations.

3. All trees shall be cut with a saw whenever practicable.

4. In no case shall the height of the stump exceed the thickness or diameter of the tree 2 feet above the ground.

5. No tree shall be left lodged in process of felling.

6. So far as reasonable, all branches of the logging shall keep pace with each other. In no instance will the brush piling be allowed to fall behind the cutting and removing of logs.

7. All tops and litter from trees cut under these rules must be burned so as to be safe against fire, under the supervision of the Inspector of the Bureau of Forestry, and at such time as he shall select, but the burning of tops or other material larger than 8 inches in diameter, or of tops or litter not made by logging under these rules, will not

be required. The piles must be compact and large enough to burn clean without repiling, and must not be so near young growth or standing green trees as to endanger either of them, and must be placed where there is least danger of the fire spreading.

8. Unnecessary damage to young growth or trees left for seed must be carefully avoided.

9. As few log roads as practicable shall be cut, nor shall they be made wider than is actually necessary.

10. All merchantable pine timber in felled trees which is 6 inches or over at the small end shall be logged. Any such timber left in the woods shall be scaled under the direction of the superintendent of logging and paid for by the purchaser of the timber at double the regular stumpage rate.

11. The use of timber in constructing corduroys and bridges or for road work shall be confined, whenever possible, to unsalable material and to dead and down timbers.

12. Merchantable pine timber used for booms, skids, dams, bridges, for building camps, or for any other purpose shall be scaled and paid for by the purchaser of the timber at the regular stumpage rate.

13. The location of log landings, loading works on the shores of lakes or streams or along railroads, and of railroad side tracks shall be subject to the approval of the inspector of the Bureau of Forestry.

14. All trees cut for booms shall be carefully measured and the booms shall be cut in such lengths as will allow all the timber to be cut into merchantable logs.

15. The maximum length for measurement of all white-pine logs shall be 16 feet, and of all Norway pine logs shall be 18 feet. Upon logs 24 inches or less in diameter 2 inches additional length, and upon logs over 24 inches in diameter 3 inches additional length shall be allowed for trimming off battered and discolored timber. Longer logs shall be scaled as two or more logs.

16. The length of logs shall be so varied that all merchantable timber 6 inches and over at the top end shall be utilized.



17. The decision of the Inspector of the Bureau of Forestry shall be final in the execution of the foregoing rules.

18. The violation of any of these rules, if persisted in, shall be deemed a sufficient cause for annulling the contract and canceling the sale of the stumpage.

#### **Irrigation Projects in New Mexico.**

A preliminary examination has been made by the engineers of the United States Reclamation Service of two important projects in New Mexico, known as the Hondo and the Urton Lake projects. A cursory examination indicates that each project is a feasible one from both an engineering and a financial point of view.

The land on the Hondo project which could be irrigated to advantage amounts to possibly 15,000 acres, and the first estimate of cost of putting the water on the land is about \$20 per acre. Land which can be irrigated most easily from the Hondo reservoir is nearly all in the hands of private parties, so that the question of colonization would cause no trouble. It is all first-class irrigable land, free from alkali, and because of the underlying limestone formation it will never be troubled from that source. The lands if watered will be easily worth \$100 an acre when planted in alfalfa or corn, and if used for fruit-raising will eventually have a higher value. The works contemplated for this project are the enlarging of the natural reservoir and an inlet and outlet canal, which involve no engineering difficulties.

The land on the Urton Lake project is all government land with the exception of a few claims bordering the river. This land is underlaid by a very porous red sandstone, which will probably afford good subdrainage and prevent trouble from alkali. The reservoir site is an excellent natural depression and will hold 190,000 acre feet without any expense except for the outlet works, which will be in red sandstone.

The works contemplated in this project are a dam and head works on the Pecos River, about ten miles above Fort

Sumner; about 36 miles of canal to carry 1,200 second feet in times of flood; three structures at crossings of creeks; the necessary outlet works, including a tunnel 7,000 feet long, and about 30 miles of distributing canals on the lands to be irrigated. A rough estimate of cost of this project is \$1,020,050, or \$17 per acre. There is little doubt that this land would all be settled up rapidly, as it is within 20 miles of the Pecos Valley and Northeastern Railroad, which line would undoubtedly build a branch to this section.

There are, however, some uncertainties in connection with the project which will have to be considered, one being the possibility of the reservoir not being filled some years. The data relating to the stream measurements are not complete, and it will be necessary to continue the records of the run-off of the Pecos River during the time the surveys of the canal and of the irrigable lands are being made and during the construction until the works are finished. It appears from the best information that the reservoir could be filled every ordinary year, but occasionally a dry year, such as 1903, creates a doubt as to the possibility of always filling the reservoir. It is probable that the seepage from the irrigated lands considered under these projects would eventually more than make up for any apparent loss below them occasioned by the proposed disposal of the water from the Pecos River.

#### **A Sanctimonious Swindle.**

Now that the federal government is fully launched on its great work of arid land reclamation, it is to be expected that real-estate boomers will take advantage of the great public interest created to float questionable enterprises. In fact, several schemes of a very shady character have already been noted.

The most pretentious scheme in this direction which has yet come to light is being promoted in Arizona, and the ever prolific field of church people is being industriously worked. A company of irrigation and evangelization has been

formed for disposing of water rights in Verde River, and the literature now being circulated throughout the East and West is in the old familiar form, with liberal references to the Lord and a careful avoidance of facts. The advertised program of the promoters is to use a portion of the profits of the irrigators, per cent not indicated, but presumably a sort of contribution-box affair, for the purpose of evangelizing the world. To start the thing, bogus water rights and a share in a canal and reservoir, which has not been and probably never will be constructed, are being offered for sale. The company's circulars are so worded as to catch the eye of churchmen, and statements are most ingeniously interwoven with sanctimonious phrases intended to supply the omission of actual facts. The promoters say:

"We are offering these water rights to Christian people who, upon the cultivation or sale of the land, will be glad to devote a portion of the profits to the extension of the Lord's kingdom. The profits will be large and we trust people will contribute liberally. We have no desire, however, to dictate the amount any one will give or through what channels the money shall be contributed. Our desire is to enable Christian people to make large profits with the hope that a large portion of them will be devoted to the Lord's work. As this is at heart a missionary enterprise, we believe the Lord would have the bonds as well as the water rights placed in the hands of Christian people. If, after prayerful consideration, you feel that the Lord would have you now complete your subscription for the water right, please fill out the inclosed application blank and send it in. We trust the reader will be ready to unite with us in the prayer that the Lord's kingdom may be largely extended through this work."

The Verde (Spanish for green) River is well named in this connection. Only the most decided greenhorn would purchase water rights in this stream, its ordinary flow being now completely appropriated for irrigation of lands in the vicinity of Phoenix. The alleged reservoir can probably never be built, and the canal, under which the people are invited

to settle, has been constructed only in a few localities where the digging is easy. The cost of completing the canal through many miles of rough country is prohibitive. All of these facts are carefully glossed over in the circulars, while the eye is attracted by the sanctimonious utterances of the fakir who is trying to extract money from the pockets of poor men. Many thousands of water rights have already been sold, and hundreds of letters are pouring in upon the Secretary of the Interior asking information in regard to the company. Governor Brodie, of Arizona, is conferring with the chief justice of the territory and an investigation will probably be ordered before the United States grand jury.

The government engineers say the scheme is impracticable; that to make any of the work done on the system available will require the construction of two high dams, one for storage reservoir and one for diversion, and a large amount of very costly canal construction. Up to the present time the company has established no rights either to their reservoir site or the water rights, and no work of construction has been done on this canal within the last five or six years.

#### **Irrigation Work in North Dakota.**

In response to the requests of citizens of North Dakota, the U. S. Geological Survey has been conducting preliminary investigation of certain sections of that state, with a view of ascertaining the advisability of constructing irrigation works. An especially important piece of reconnaissance work has just been completed of both sides of the Yellowstone River from Glendive, Montana, to its confluence in North Dakota with the Missouri.

This valley, lying in Montana and North Dakota, is described as one of the prettiest in the West, with a soil of unsurpassed fertility. Just back of the valley, on each side of the river, are large areas of grazing lands. During the years of ample rainfall, large crops are grown in the valley without irrigation, proving the productiveness of the soil.

Ordinary seasons are too dry for successful farming without irrigation. The survey was started opposite Terry with a view of taking out a canal at that point and continuing it to the Missouri River. This survey proved that nearly as much land could be covered, and at much less cost, by taking out a canal near Glendive. The preliminary survey is almost completed, and, when finished, the practicability of the project will be determined.

The rapid increase of settlers in the western, or arid, portion of North Dakota in the last three years has not been unnoticed by the Survey, whose efforts are being directed to secure for them an ample supply of water against the occurrence of insufficient rainfall. Owing to the unusual problems presented, the work must necessarily be slow, as it will require very careful consideration of methods and cost. The Missouri River is the principal source of water supply for the region in which irrigation will be required; owing to its slight fall in the state, gravity canals are practically impossible, unless they head in Montana. Such preliminary work as has been done shows that such diversion is possible but expensive, and only detailed surveys can settle the question of its practicability.

An investigation is being made of the possible utilization of the Missouri by pumping plants in sections where lignite abounds, and a report thereon will shortly be published.

#### **Irrigation in Sacramento Valley.**

An appropriation of \$60,000 made by the California legislature last winter for the development of irrigation in the state, the greater part of which is being expended by the United States Geological Survey, has served to exploit greatly the latent capacity of the state for developing irrigation, as well as to emphasize the urgent need of definite policies for future work along similar lines.

The topographic and hydrographic branches of the Survey have together undertaken the mapping of the irrigable lands of the Sacramento Valley and are pushing the work vigorously. During

the coming winter there will be surveyed at least four 15-minute quadrangles on a scale of 1 mile to the inch, with contour intervals of 5 feet. It is the intention, if feasible, to complete the survey of the Sacramento Valley on this scale from this appropriation. Other topographic work is being carried on simultaneously in the drainage basin of Kings River.

The work of stream gaging in California has been greatly extended by the Survey, and gaging stations are now maintained on 35 streams. In addition to this, a general reconnaissance is being carried on in the drainage basin of the Sacramento River for the purpose of discovering existing reservoir sites and for the survey thereof. Under the direction of Mr. J. B. Lippincott, supervising engineer, his assistant, Mr. H. E. Green, is making a careful examination of this whole drainage basin with a view of determining upon a comprehensive scheme for the irrigation of Sacramento Valley. Unusual opportunities are offered here because of the fertility of the soil, the mild character of the climate, which permits of semi-tropic fruits, and the abundant water supply.

The mountainous portions of this drainage basin are heavily covered with timber, which is being rapidly exhausted by lumbering operations. Because of these denudations, the Bureau of Forestry of the Department of Agriculture is making a careful study of these timbered areas. It is expected that forest reservations which have been tentatively withdrawn will be thoroughly investigated because of this coöperation, and that recommendations will be made, not only for a proper national forest policy, but also for a proper code of state forest laws.

In all of these lines of investigation the personnel of the field parties is selected by the proper authorities in Washington, and the field expenses are in greater part being paid by the state, the result being that the state furthers, to its own great advantage, the work of the experienced corps of trained men from the scientific bureaus of the government, with which California is co-operating.



OVERTON W. PRICE,

ASSISTANT FORESTER, U. S. DEPARTMENT OF AGRICULTURE.

OVERTON W. PRICE, as assistant forester, has duties of high importance to the forest interests of the country. He is a trusted counsellor of Gifford Pinchot, the head of the Bureau of Forestry, and is acting forester during the absence of the latter in the field. His work is mainly confined to the Bureau's headquarters at Washington, where he is engaged in looking after the details of the technical side of this rapidly growing organization. This is a matter of prime importance, and Mr. Price's wide knowledge of forest matters and his activity in directing this technical work has contributed in no small measure to the success of the Bureau's undertakings during recent years. Although a young man, Mr. Price began his present work with an unusually good preparation. He was born in Liverpool, England, January 27, 1873, of American parentage. His education was first received in England, later at the Episcopal High School, Alexandria, Va., and at the University of Virginia. After deciding upon forestry as a profession, he spent one year in forest work in the United States. He then went to the University of Munich, Germany, where he studied for two years. He did practical work in the woods of Europe for one year, after which he returned to America. Some time was spent in forest work at Biltmore, N. C., and in the logging camps of the North. Mr. Price entered the government forest service in June, 1899; he became Superintendent of Working Plans in July, 1900, and upon the advance of the Division of Forestry to a Bureau he was appointed Assistant Forester. Mr. Price is a forceful writer, and is a frequent contributor to leading magazines and government publications on forest topics.

## THE GUNNISON TUNNEL.

A FULL DESCRIPTION OF ONE OF THE MOST INTERESTING OF THE MANY IRRIGATION PROJECTS UNDER CONSIDERATION BY THE FEDERAL GOVERNMENT.

BY

A. L. FELLOWS,

RESIDENT ENGINEER, U. S. RECLAMATION SERVICE.

LESS than a quarter of a century ago the greater part of western Colorado was occupied by a tribe of Indians known as the Uncompahgre Utes, and from them Uncompahgre river and valley, peak, and plateau have derived their names.

The first authentic information we have concerning this region is obtained from the report of the explorations of Capt. J. W. Gunnison, of the corps of topographical engineers, who had charge of the parties sent out by the Government for the purpose of determining whether it was feasible to construct a line of railroad from the Mississippi River to the Pacific Ocean. The report of this expedition being found in volume II of "Pacific Explorations."

The party was organized on May 20, 1853, the authorization for the expedition having been granted by Jefferson Davis, then Secretary of War. The river, which was afterwards called Gunnison River in honor of its discoverer, but which he himself called Grand River, was explored between August 25 and September 20, 1853, entry into its drainage basin being made from the Rio Grande basin on the south by way of Cochetopa Pass.

Gunnison traversed the river valley until he reached the point where Sapinero is now, where, finding the canyon practically impenetrable for such a large party, he ascended the hills on the south, and after a most difficult crossing of Lake Fork, he crossed the high country until he reached the head of Cedar Creek, a small tributary of the Uncompahgre. He followed this until he reached the valley where Montrose, Olathe, and Delta are now situated, but

then inhabited only by the Ute Indians, with whom he was soon on friendly terms. Captain Gunnison did not visit that portion of the Gunnison River afterwards named by Hayden the "Grand Canyon of the Gunnison." The Indians reported to him that it was a deep chasm inaccessible to man, and he therefore took the more open country to the south, passing within about sixteen miles of this canyon. The Uncompahgre Valley was reported by him as a desert country, habitable only by Indians, and unfitted for cultivation.

From where Delta is now located the party crossed to the north side of Gunnison River, and kept along that side until it reached what is now known as Grand River, but which was then called Nahunkahrea, or Blue River.

The entire period of time occupied under the leadership of Gunnison was between May 20 and October 26, 1853, he and others of his party being massacred by the Pahute Indians on Sevier River, in Utah, upon the latter date, after which the expedition was completed under the direction of Lieut. E. G. Beckwith, who made the official report.

The next definite knowledge which we have concerning this region is that furnished by the surveys of Prof. F. V. Hayden, whose men surveyed this territory in 1873 and 1874. His report speaks of the desert nature of the Uncompahgre Valley and the rugged character of the Grand Canyon and Vernal Mesa. His men did not descend to the river along Grand Canyon, but reported that it was inaccessible.

The Indians were removed from this region into Utah in 1881, and settlement by the whites commenced soon after-



ward. In 1884 construction of irrigation ditches may be said to have commenced. The Uncompahgre River, which flows through the valley of the same name for a distance of some 80 miles, was supposed by the early settlers to furnish an inexhaustible supply of water, and large canals were constructed under that delusion. As most of us know, similar delusions have prevailed in other places. In reality, as elsewhere also, the supply furnished by this stream is totally inadequate to irrigate satisfactorily even the tenth part of the valley. Consequently the greater part of its area, although filed upon under the preemption act, and although final proof was generally made, was afterward deserted and relapsed to a barren waste. This called the attention of the residents of the valley to the fact that the Gunnison River, carrying a considerable volume of water unused to the sea, was flowing parallel to the valley at a distance of only a few miles from its principal towns. They therefore looked longingly toward this additional supply of water, which would if available accomplish that which they had hoped from the waters of the Uncompahgre, namely, the reclamation of the Uncompahgre Valley.

As early as the year 1890 some study was made of the relative elevations of the Gunnison River and the Uncompahgre Valley with reference to the proposed diversion. At that time an effort was made to interest the legislature of the State of Colorado in the diversion of the water from the Gunnison, which effort, however, resulted in nothing except drawing the attention of irrigators to its possibility. The subject was fre-

quently discussed, however, and in 1894 and 1895 investigations were made by F. C. Lauzon, assisted by local engineers, who demonstrated that the Gunnison River was high enough so that it would be possible by means of tunneling to divert its waters into the Uncompahgre Valley. The estimates made concerning the cost were ludicrously



A. L. FELLOWS, IN SURVEYING THE GRAND CANYON OF THE GUNNISON RIVER, FINDS A DEEP PLACE AND IS FORCED TO SWIM; SACK OF CORK USED FOR BUOY.

low, it being estimated by one surveyor that \$75,000 was sufficient to construct about 7 miles of tunnel, a mile or so of heavy cut, and a dam across the Gunnison approximately 100 feet high. He probably hit within one thirtieth of the true cost. Those who have had much to do with building irrigation works will be familiar with similar instances.

From time to time different parties tried to penetrate the apparently unfathomable mysteries of the Grand Canyon. The engineers of the Rio Grande Railroad made a survey in 1881 which extended down through the Grand Canyon for about one-half its distance, at which point the party gave up the attempt and climbed out of the canyon after losing some of their surveying instruments. Another party attempted, by means of sledges, to traverse the canyon on the ice in the winter time, but after penetrating it about 6

rence, of Montrose. They attempted the passage of the canyon by means of wooden boats bound with iron, furnished by Mr. Pelton, and after the greatest hardships, lasting for a period of twenty-one days, and the loss of both boats and all the rest of their equipment, they emerged from the canyon at a point which was called by them the Falls of Sorrow. This name being given to what appeared to be falls of considerable height some distance below, which they believed, owing to the narrowness of the canyon, could not be safely passed.



SHOOTING THE RAPIDS OF THE GRAND CANYON OF THE GUNNISON IN A CANVAS BOAT.

miles gave up the attempt and retraced their steps.

The most notable and daring of all these earlier attempts to explore the canyon was that made by a party of five residents of the Uncompahgre Valley, whose names should pass down in history as pioneers in the early attempts to demonstrate the feasibility of diverting the waters of the Gunnison. This party was led by John E. Pelton, of Montrose, the other members being J. A. Curtis and E. B. Anderson, of Delta, and M. F. Hovey and W. W. Tor-

The history of their climb from the canyon and hardships encountered in reaching an inhabited region will live forever in the annals of Montrose and Delta.

In the meantime, however, ever since the year 1890, the eyes of some of the officers of the Hydrographic Division of the United States Geological Survey had been fixed upon this locality. For several years, commencing with 1895, when a gaging station was established on the Uncompahgre at Fort Crawford by A. P. Davis, now supervising engi-

neer of the Reclamation Service, stream measurements were made at various points. This was done both on the Uncompahgre and on the Gunnison, for the purpose of ascertaining the flow of these streams with reference to possible future development.

In the year 1900 direct efforts were made by officers of the Survey to have the possibilities developed by surveys, and, although it seemed almost out of the question at that time to raise funds in the Survey for such a purpose, enough interest was manifested to authorize the expenditure of \$4,000 in a preliminary examination. This authorization was granted by the Director of the Geological Survey, Hon. Charles D. Walcott, in the winter of 1900-'01, considerably more than a year before the passage of the National Irrigation Act, it being expected that the actual work of surveying would commence in the spring.

Field work was actually commenced the first week in June, 1901, when a party under my direction camped upon what has already been called the Vernal Mesa, and commenced the survey. The work of this season was primarily that of determining whether the river bed was high enough to permit of covering any great area of land by means of a tunnel short enough to insure the practicability of the project.

A topographic map of the Vernal Mesa was completed and a reconnaissance exploration of the Grand Canyon of the Gunnison was made by myself and William W. Torrence, of Montrose. The difficulties to be overcome were all that had been suspected by those who had made the unsuccessful attempts in

previous years. The exploration was safely concluded by swimming, however, although at great physical cost to both the explorers, but it was shown to be possible. These facts also were demonstrated:

First. That the Gunnison River was high enough to water practically the entire Uncompahgre Valley;

Second. That every part of the river



SURVEYING IN THE GRAND CANYON.

could be reached at low stages, so that it was possible to make detailed surveys; and

Third, that dam sites and sites for the development of power abounded to such an extent that there would be no difficulty in constructing whatsoever headworks might be needed at any point that might be selected.

In October of the same year, 1901,

Whitman Cross, geologist, made an examination and report concerning the strata which would in all probability be penetrated by the projected tunnel, it having been found that a tunnel of approximately six miles in length would convey water to such levels in the Uncompahgre Valley that practically all of the arid lands would be reclaimed.

All of the money available having

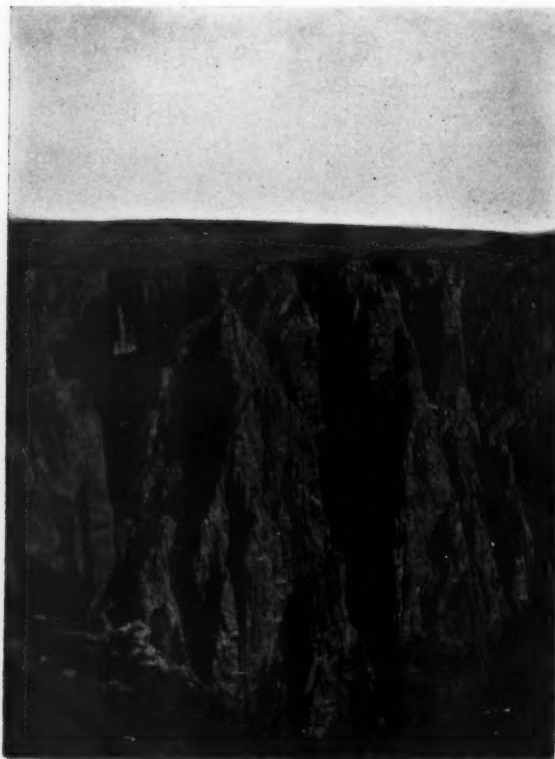
proposed roads, and similar work. A start was also made late in the fall upon the topographic mapping of the region to be reclaimed, but bad weather coming on, this work had to be abandoned before much had been accomplished.

Early in March, 1903, the Secretary of the Interior took under advisement the reports concerning the various projects which had been examined into by the Geological Survey, and among the five accepted for further examination was the so-called Gunnison Tunnel Project, or, more properly, the Uncompahgre Valley Project. It is extraordinary that five projects could have been so far selected out of the hundreds offered for examination within nine months from the time that the National Irrigation Act was signed, in a winter season of unusual severity.

As soon as practicable in the spring of 1903 work was resumed upon the surveys necessary for a detailed report concerning the various projects. The topographic mapping of the Uncompahgre Valley was recommenced in April, but for the first two months was limited to triangulation and traverse work, no topographers being available until June. The survey is still in progress. The principal work under way at the present time is that of completing a topographic map of the valley.

The topography of the canyon has been obtained, so that as soon as certain details are decided upon actual construction can be commenced.

In the meantime, some time after Mr. Walcott had authorized the survey, the legislature of the State of Colorado became interested in the project, and appropriated the sum of \$25,000 for the purpose of commencing construction and of interesting private capital. But,



GRAND CANYON OF THE GUNNISON FROM ABOVE, LOOKING DOWN TOWARD HEAD OF THE PROPOSED TUNNEL.

been expended upon this survey, nothing further could be done until July 1, 1902, after the passage of the National Irrigation Act. Commencing early in July of that year the surveys for the proposed system were continued, the work consisting principally of preliminary location of proposed canals, running primary levels, traversing and leveling along the canyon, surveying for

after a consultation between the officers of the Survey and the State Board of Control, appointed for the purpose of carrying out the provisions of the act, it was decided that nothing should be done in the way of actual construction until the preliminary examination being made by the Geological Survey was completed.

In October, 1901, however, this board selected a point at the lower or Uncompahgre Valley end of the tunnel and started men to work at this point, continuing this work as long as funds were available. The people of the Uncompahgre Valley, however, were persistent in their petitions that the United States Government should take charge of this work, and in March, 1903, during the regular session of the state legislature, a bill was passed making it possible for the board to turn over all work done and all materials on hand to the United States Government.

Owing to the fact that so large a portion of the territory to be irrigated has been in private ownership, it has been necessary for the people of the Uncompahgre Valley owning lands therein to form an association, which should unify the various agricultural interests of the valley and make it possible for the government to construct this project with the assurance of the coöperation of the people and the necessary guarantees as to the return of the money expended, this being essential under the terms of the National Irrigation Act.

The people of the Uncompahgre Valley have been enthusiastic throughout in doing whatever was required of them, and many of the most prominent citizens have given most generously of their time and labor, among the foremost of whom is the Hon. John C. Bell, although comparisons can hardly be made where all have been so unanimous in furnishing assistance. As a result of these efforts, an association has been formed, the articles of incorporation of which provide for the issuance of one hundred thousand shares of stock, assessable up to twenty-five dollars per share, it being estimated that \$2,500,000 will be sufficient for the completion of the project. Over sixty thousand shares

have already been subscribed, and it is a noteworthy fact that those who have needed water least have been foremost in subscribing. This is due principally to the fact that the land which still remains desert has passed into the hands of non-residents and real-estate companies, difficult of access, who do not appreciate the advantages which would accrue to them. There is no doubt, however, but that all of the arid lands that can be benefited by this project will eventually come into the association, and at the present time the outlook is bright for the early commencement of construction.

Having given as briefly as possible a little of the history of the movement which seems likely to result in the actual reclamation of the Uncompahgre Valley under the terms of the National Irrigation Act, I wish to present a brief description of the physical relations existing between the Gunnison River and the Uncompahgre Valley.

The Gunnison River, rising in the Rocky Mountains in the south central part of Colorado, flows in a generally westerly and northwesterly direction until it empties into the Grand near the center of the western end of the state. The Uncompahgre River empties into it from the south, rising in the high mountains of southwestern Colorado, the principal ranges of which are the San Miguel and Saw Tooth ranges, the highest peaks of which are Mount Sneffels and Uncompahgre Peak, each over 14,000 feet in elevation.

There appears to have been at one time a tremendous upheaval in this region, accompanied probably by the subsidence of other portions, the result being that there is an elevated plateau lying between the Uncompahgre River and the North Fork of the Gunnison. And through the very center of this elevated plateau, running through a canyon well named the Grand Canyon, for in many respects it equals and in some it surpasses in scenic grandeur the more widely known Grand Canyon of the Colorado, is the Gunnison River, which, although from two to three thousand feet below the surrounding country, is still higher than the valleys



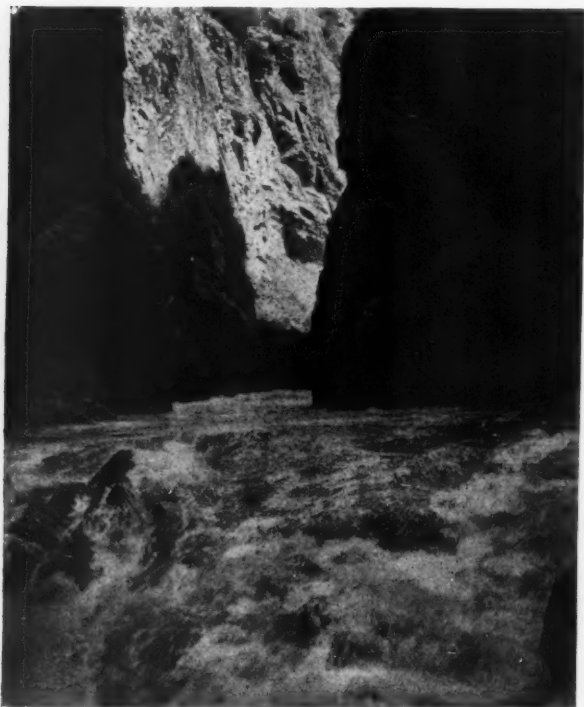
from 15 to 20 miles on each side. Of these two basins the larger, and at the same time the nearer, is that of the Uncompahgre. In fact, only this one is low enough so that any great portion of it could possibly be irrigated by water from the Gunnison River. The Uncompahgre Valley, described by Captain Gunnison as a barren waste, is in reality extremely fertile when irrigated. Ap-

irrigated have demonstrated that the choicest of apples, plums, peaches, and similar fruits can be raised to advantage, and that large crops of alfalfa and all kinds of hay and grain may also be profitably raised. Approximately 110,000 acres of this 175,000 have passed into private ownership. But, for the reasons previously stated, by far the greater part of it has been deserted,

and although efforts are made to irrigate about 40,000 acres, the amount of water available will, as stated above, suffice for about 10,000 only. It is no wonder, then, that the people of this valley who own the lands have been most anxious for the waters of the Gunnison.

The facts, then, are these: Upon the one hand there is a broad and fertile valley where \$100 per acre is a low value for lands with good water rights, but which lack the water necessary to develop it. On the other hand, a river carrying volumes of water sufficient for the irrigation of all the arable lands is flowing unchecked to the sea at a tantalizingly short distance from the valley which has been the grave of the hopes of thousands of people in the past. And it will be the grave of the

hopes of many more, provided they cannot get water for the irrigation of their lands, for the local water supply is getting shorter every year. By the construction of the necessary headworks and a tunnel 6 miles in length it is proposed that the water shall be brought from the river to the valley. A distributing system of some 80 or 90 miles of canals will then be required to bring the water to the lands of the irrigators.



PROPOSED DAM SITE IN GRAND CANYON OF THE GUNNISON  
DURING HIGH WATER.

proximately 175,000 acres of this valley are so low as to be irrigable from the Gunnison River, if a tunnel should be constructed penetrating the Vernal Mesa, through which the Gunnison Canyon passes. Of this 175,000 acres, lying at an altitude on the average of about 5,500 feet above sea-level, perhaps 10,000 acres can be satisfactorily irrigated from the natural flow of the Uncompahgre River. And lands thus

The cost will be great, for 6-mile tunnels and such canals as it will be necessary to have constructed are not built for nothing, but the advantages gained will be even greater. The extraordinary fertility of the Uncompahgre Valley, the fact that the climate is suited to the raising of the finest of fruits, and that all other crops indigenous to temperate zones are most profitably raised are assurances of success which cannot be doubted. It is easily within the bounds of reason to say that the expenditure of \$2,500,000 would result upon the completion of the system in adding \$10,000,000 to the wealth of the country.

The fact that those who need water least have been first to subscribe for shares demonstrates beyond question that the value to the non-irrigated lands

which are now lying waste and desert will be greater than to those that are already irrigated or partially irrigated. I foresee that five years hence the Uncompahgre Valley, instead of being, to a great extent, a land of deserted claims, of houses going to ruin, and of tracts once plowed, but now given over to greasewood and the prairie dog, will be a land of happy homes, where all nature will smile. Then those who have given the best efforts of their lives to this work, like those early pioneers who traversed the dangerous defiles of the canyon and suffered hardships of every kind that this work might be consummated, may congratulate themselves that to them, as well as to some of the highest in the land, is due the credit for this mighty step in the upbuilding of our great West.

## THE LUQUILLO FOREST RESERVE, PORTO RICO.

FROM DATA COLLECTED BY AN AGENT OF THE BUREAU OF FORESTRY DURING THE PAST SUMMER.

BY

DR. JOHN GIFFORD.

ON the 17th of January, 1903, the Luquillo Forest Reserve in Porto Rico was created by presidential proclamation. After July first of this year all public lands in the island not previously reserved became the property of the insular government. This valuable bit of virgin jungle in the lofty Sierra Luquillo, including El Yunque, the highest mountain on the island, is now permanently reserved for federal purposes and is under the control of the Bureau of Forestry of the Department of Agriculture.

The reserve includes all land not privately owned between longitudes  $65^{\circ} 55'$  and  $65^{\circ} 45'$  and latitudes  $18^{\circ} 12'$  and  $18^{\circ} 14'$ , of which area probably not more than half is in forest. This forest is located in a practically unexplored

and extremely rugged mountain region. It is surrounded first by coffee plantations and further down by fields of grass, cane, and corn. There are no roads and practically no trails in the forest. The few trails which exist are impassable in wet weather. It is a veritable *terra incognita* in one of the most thickly populated islands in the world. It is a virgin tropical jungle on an island which is practically elsewhere completely deforested even to the peaks of high mountains.

This part of the island has never been surveyed. One official map places the town of Rio Grande a mile or more within the reserve; another locates it a couple of miles on the outside. All the maps of the eastern part of the island are of little use, for mountains, trails,

and streams were roughly sketched in by guess. The heights of the highest mountain peaks except El Yunque are unknown.

The commonest timber tree of the Luquillo reserve is the Tabonuco (*Dacryodes hexandra*). It is called Torch-wood in English islands. The timber is similar in appearance and is about equal in value to our Yellow Poplar. The tree, when gashed with a machete, yields a large quantity of resinous gum, which is used for candles, incense in churches, torches, soap, and other purposes. If

much more than Tabonuco. Ausubo is hard, durable, and dark brown or reddish in color. It is called Ironwood or Mastic in English islands. This wood, although expensive, is extensively used for beams and rafters, and much of it is being stolen from the government lands. Another valuable wood is *Laurel sabino*, a species of magnolia. The flowers and leaves of this tree resemble *Magnolia glauca*. The wood is olive-colored at first, but in time changes to reddish brown.

Now and then one finds specimens of other trees, some of them such as Palo-Colorado of colossal size. One of these was found that measured seven feet in diameter breast high. Cedar trees (*Cedrela odorata*) grow in these mountains, though they are scarce. A valuable tree similar to the cedar, called Guaraguao (*Guarea trichiliodes*), occurs here and there. In addition there are many other kinds, but I have never seen the true Mahogany on the island, although it is said there are a few Mahogany trees on the Island of Vieques.

It is more likely that a large part of the island of Porto Rico was never very heavily wooded. The shore vegetation of the island is like that of



A SCENE IN THE FOREST, SHOWING A FAIR SPECIMEN OF THE LAUREL-SABINO, A TROPICAL MAGNOLIA.

a use could be found for this material in the states, enormous quantities could be collected without serious injury to the trees. Many of these trees are five feet in diameter and free from limbs to a height of fifty feet. They may be found in groups of twenty to thirty here and there.

Like most tropical forests, many species of trees are mixed, so that making an estimate of the amount of timber is difficult. A very valuable tree is the Ausubo (*Sideroxylon mastichodendron*). Although not as abundant, it is worth

almost all tropical shores throughout the world, but the inland vegetation is dense only in those places where there is an abundance of moisture throughout the year.

Large parts of the Luquillo Forest Reserve are covered with tall palms and tree ferns, which seem to be gaining ground. The surface is covered with brush and vines, so that progress is impossible without the help of peons with machetes.

The soil is a sticky clay, which when mixed with humus and water has the

consistency of thick paint for several inches. As far as I have been able to determine, no natives live in the forest. They shun the dampness and coolness of the night, and have a superstitious dread of the spirits which they say dwell in the forest-covered recesses of these mountains. They come to it daily, however, in large numbers to wash out gold from the gravel in the stream beds. With these particles of gold they buy those things which they cannot manufacture at home. These wants are few, because the natives are exceedingly primitive; many have the dark skin, high cheek bones, and long, straight black hair of the ancient Borinquen.

Timber is being and has always been stolen by the natives. Only small-sized sticks, principally Ausubo, are cut. It is hewn and sawn by hand in the forest, and then slid or carried on the backs of men to the nearest trail. It is then snaked down the mountain



VAL VERDE, HOME OF JUDGE JAMES N. MAC LEARY, VICE-PRESIDENT OF THE AMERICAN FORESTRY ASSOCIATION FOR PORTO RICO.

side to the nearest road by a yoke of oxen. Coffee is often carried out from the plantations in canoes or boats hollowed from the trunk of a tree. These are dragged down the trails by large oxen or bulls yoked by their big, sharp horns. It is not pleasant to meet these animals tearing down a narrow, steep trail, especially if one is mounted upon a rat of a pony with a native basket saddle.

On the edge of the reserve I have seen "deadening" similar to those of North Carolina, where big trees have been girdled to make room to grow coffee. The coffee is grown in forest-like shade, but the trees preferred are usually leguminous, such as Guama (*Inga laurina*) and Guava (*Inga vera*), which tree should not be confounded with *Psidium guajava*, which bears the tropical fruit called guava in English, but



ONE OF THE MANY LITTLE WATERFALLS IN THE LUQUILLO FOREST RESERVE.

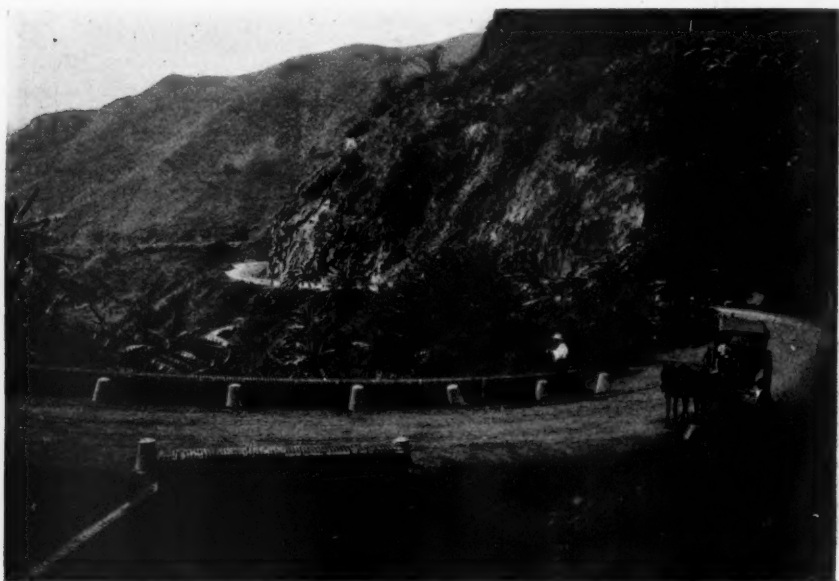
by Porto Ricans more correctly termed guayava.

The virgin character of this reserve is due to its inaccessibility. To be sure, it is only a few miles from the capital of the island and in sight of such a town as Fajardo, but one must cross many streams which are at times raging torrents and ascend trails on horseback which are so steep and slippery that even the sure-footed Porto Rican pony falters. A dirt road or trail in these mountains is soon worse than none, for in a very short time it becomes a mass of yellow mud several feet in depth. A day without rain in these hills is the exception, and at times it rains for days with a fury which is only equaled in other tropical districts. The constant trade winds, fresh from the sea, pile the clouds against the cool hilltops. In the valleys it is perfectly still, even the banana leaves are not tattered, and it feels like a Turkish bath. The sun may be shining brightly; suddenly it is obscured, and by the time one can cover himself with his poncho he can hear the roar of the big rain drops pelting the tropical foliage.

Fortunately the government land is practically in one central piece. A stone or gravel road through it is not impossible, and would not be more expensive per mile than many other roads throughout the island. It would make a grand tropical park. With a good road across it, one could go through it by coach from San Juan on the north to Naguabo on the south side in one day.

The main function of this park should be not so much to yield timber, because that can probably be imported from the States as cheaply as it could be cut, manufactured, and transported from the reserve to the coast, but to protect the headwaters of streams that become raging torrents which do no end of damage when the rains are heavy. The streams which rise in these mountains are already boisterous enough. Were we to cut these forests and bare these steep mountain sides for rice and grass, as has been done elsewhere throughout the island, it would be difficult to predict the amount of damage which would result.

The power from these streams will all be utilized some day, especially on



THE CELEBRATED MILITARY ROAD WHICH CROSSES THE ISLAND OF PORTO RICO.



the big sugar centrals which are being established in the lowlands. These streams, dashing down steep mountain sides, are capable of yielding enormous power. This could be easily transmitted throughout the eastern end of the island. For this purpose regularity of flow is essential, and can only be secured by a protecting forest cover.

The Gurabo, one of the main branches of the Rio Loiza, the largest river in Porto Rico, rises in these mountains. In addition, there are the Rio Canovansas, Rio Grande, Rio Espiritu Sancto, Rio Marneyes, Rio Sabana, Rio Fajardo, and Rio Blanco, with many branches, all of which are good water powers.

In short, the federal government has in this reserve an unspoiled virgin, tropical, mountain forest, free from fire, grazing, poisonous snakes, and undesirable inhabitants. It is unfit for cultivation, but excellent for a park, from the standpoint of wild scenery

and rare plants, and essential as a protector to the headwaters of streams which will be invaluable for power some day, in a land where fuel is scarce. Unrestrained by forest and unbridled by industry, these streams of clear, pure water are likely to develop into exceedingly muddy and dangerous torrents.



A VIADUCT USED FOR IRRIGATION PURPOSES NEAR YANCO.

## THE IRRIGATION LAWS OF NEVADA

BY

A. E. CHANDLER,

STATE ENGINEER OF NEVADA.

THE first act dealing with the matter of water rights in the State of Nevada was passed on March 3, 1866. It provided "that any person desiring to construct a ditch or flume within any one or more of the counties of this state shall make, sign, and acknowledge before some officer entitled to take acknowledgments of deeds a certificate specifying, first, the name by which the

ditch or flume shall be known, and, second, the names of the places which shall constitute the termini of said ditch or flume. Such certificate shall be accompanied by a plat of the proposed ditch or flume and shall be recorded in the office of the county recorder of the county or counties within which such ditch or flume is proposed to be located; and the record of such certificate and

plat shall give constructive notice to all persons of the matters therein contained."

The second irrigation act was passed on March 9, 1889. The act provided for the filing, before September 1, 1889, of claims showing the names of appropriators; their post-office addresses; the name of the ditch; location of headgate; general course of ditch; source of supply; length, width, depth, and grade of ditch; date of original appropriation; date of extensions or enlargements; the amount of water claimed, and the number of acres lying under and being or proposed to be irrigated. Special books were prepared for the record of claims made under this act.

The law of 1889 provided also for the division of the state into districts along drainage lines. Commissioners were to be appointed in each district to control the lawful distribution of water. Questions of priority on each stream were to be settled by the regular district court, and no person was to be allowed to testify before the court until his certificate of claim had been filed according to the provisions of the law.

The act of March 9, 1889, was repealed February 3, 1893, and nothing more was done in water-right legislation until the session of 1899. The law passed March 16, 1899, was intended to inaugurate a system similar to that of Wyoming. The county commissioners and county surveyor of each county were to constitute a board of water commissioners, with duties and powers almost identical with those of the board of control in Wyoming. The bad feature of the law was that the administrative unit was the county and not a distinct drainage basin. The larger rivers in Nevada run through three or four counties, and under the provisions of the law these rivers would have three and four boards of water commissioners trying to settle the question of priority within their limited jurisdiction, instead of one board adjudicating the rights on the entire stream.

Section 20 of the act reads:

"It is left to the discretion of the boards of county commissioners severally whether such county shall avail

itself of the provisions of this act as to the forming of a board of water commissioners." No board availed itself of the privilege, so the law was never operative, although section 6 provided that the prior right to unappropriated water must be acquired after the manner provided in the act, and not otherwise.

#### THE IRRIGATION LAW OF 1903.

The real incentive to the passage of the new irrigation law at the last session of the state legislature is clearly shown in the last clause of the preamble introductory to the act, which reads as follows: "Whereas it is the desire of the State of Nevada to cooperate in every way with the Secretary of the Interior in the construction, operation, management, and maintenance of irrigation works in the State of Nevada under said act,\* and it is to the interest of the State of Nevada that every inducement should be held out to the Secretary of the Interior by cooperative and helpful state legislation to enter upon the work of construction, operation, management, and maintenance as aforesaid: Now, therefore, the people of the State of Nevada, represented in Senate and Assembly, do enact as follows:"

The important provisions of the bill are: 1. All natural water-courses and natural lakes, not in private ownership, belong to the public and are subject to appropriation for a beneficial use.

2. The right to the use of water so appropriated for irrigation shall be appurtenant to the land irrigated, and beneficial use shall be the basis, the measure, and the limit of the right.

3. The maximum quantity of water which may be used for irrigation purposes shall not exceed three acre feet per year for each acre of land supplied.

4. The office of state engineer is created. He shall be appointed by the governor on the recommendation of the Secretary of the Interior or the Director of the United States Geological Survey.

5. The state engineer shall cooperate with the Secretary of the Interior in all work of construction, operation,

\* "Said act" refers to the Reclamation Act passed by Congress in June, 1902.

maintenance, and management of irrigation works constructed by the Secretary of the Interior in and for the benefit of Nevada, and shall in every way facilitate the work of the Secretary of the Interior in carrying out the provisions of the "Reclamation Act" in Nevada.

6. The state engineer shall prepare for each stream a list of the appropriations of water according to priority.

7. The State Board of Irrigation shall divide the State of Nevada into water districts, and may appoint water commissioners to divide the water according to the adjudications in each district. The water commissioners shall be appointed upon the recommendation of the Secretary of the Interior or the Director of the United States Geological Survey.

The new law is certainly infinitely better than any previous one. The law of 1889 left the adjudication of rights to the district courts, and no stream or ditch measurements or surveys of irrigated lands were provided for. The law of 1899 dealt almost entirely with

the control of new appropriations and utterly ignored the adjudication of existing rights. The present law emphasizes the cardinal principle that water must be appurtenant to the land irrigated, and that actual beneficial use must be the measure of the right.

The duty of water is dealt with in a way which is novel in irrigation legislation. Other state laws prescribe one second foot to a stated number of acres, and as the irrigation season is not fixed by law, no definite amount is thereby specified. Three acre feet per acre per year is small compared with what farmers are using under present wasteful methods, but it is sufficient when properly handled.

The law makes no reference to the control of new appropriations, so they are still governed by the first law of 1866.

Besides the laws in regard to water rights, an important law was passed in February, 1889, making it unlawful to allow water to run to waste on sagebrush or greasewood land during the irrigating season.

## FORESTRY AT BILTMORE.

BY

DR. CARL ALVIN SCHENCK,

FORESTER OF THE BILTMORE ESTATE.

**F**ORESTRY, in the eyes of the forest-owner, is merely a business possibility.

The proprietor will necessarily pursue that course, in dealing with his property, which, in his opinion, promises the best financial results. Where, and as long as, timber prices are small, the owner, expecting little prospect for betterment from future developments of the timber market and embarrassed, possibly, by a large annual outlay incurred to defray taxes and to safeguard the forest from fires, will necessarily engage in "destructive forestry." He will withdraw from the forest, by cutting the trees, its chief taxable value and its chief assets

endangered by fires. Under such circumstances, if forestry is business, the course pursued by the owner—namely, the slaughter of the forest—is the best business course, the best forestry.

Similar is the result of merely business considerations where the forest stocks on good agricultural soil, where it forms a hindrance to the more remunerative use of farming.

On the hardwood-covered slopes of the Alleghany Mountains the conditions surrounding the prospects of conservative forestry are more promising. Taxation, at the time being, weighs heavy on the owner; the annual taxes, amounting to about 1 per cent of the forest



VIEW OF THE MOUNTAIN FORESTS AT BILTMORE AFTER LUMBERING.

value, do, however, not deprive the owner of all hope for a remunerative outcome of his ventures. Fires frequently run over the ground, killing the young growth, but scratching only the Oak, the Chestnut, the Yellow Poplar, and Hickory of merchantable size. Under proper precautions, and assisted by the good will of friendly neighbors, the fire scourge can be altogether banished from the forest. In addition, the price of hardwood timber has been rapidly increasing of late years, with the gradual decline of primeval supplies formerly adorning the Ohio and Mississippi valleys. The competition of millman, cooper, and tie-cutter has raised the price of Oak, the demands of the tanning extract plants that of Chestnut, and the requirements of the wagon works the price of Hickory. No wonder, then, that an owner of large mountain tracts stocked with hardwoods does not look askance at the financial prospects of his investments! More than tree growth,

however, can be often relied upon for returns from such holdings. The wind-swept mountain ridges, carrying only a stunted growth of timber, offer from May to November splendid pasturage for cattle; on the lower and dryer ridges sheep can be kept all the year round with practically no artificial feeding. Fish and game, on ground protected from trespass, increase rapidly, and large sums are offered by sportsmen's clubs for the privilege of hunting and fishing on such preserves. If I further mention the untouched mineral resources—mica, kaolin pyrites, manganese, etc.—of our mountains, the development of which will be helped by a steady and nearby timber supply, the owner and his forester might be excused from the reproach of entertaining optimistic ideas relative to the final outcome of the forestal venture.

Where there is light there is shade also, and the darker sides of conservative forestry at Biltmore lie, on the one

hand, in the lack of natural means of transportation, like navigable lakes and rivers, or like the snow of the northern winter, allowing cheap sleighing to take the place of expensive wagoning; on the other hand, in the quality of the local labor, supplied by the half-starved descendants of the sturdy settlers, who saw in the mountains their homes and their happy hunting grounds.

The work at Biltmore is conducted along lines laid down in a working plan approved by the owner in 1896. The plan proposes to gradually develop the resources of the forest—now about 125,000 acres—in such a manner as to make the entire investment remunerative from the year 1916 on.

As a matter of fact, the prosperous condition of the country at large and a handful of good luck enable us to figure on a surplus revenue from the year 1907 on.

"Is that all?" you will say, astonished. "Do you mean to say that since 1896 your forests have been working at a loss?"

Let me put before you a counter-question: Do you know of any farmer who, from the start on, locating in uninhabited prairies and without additional investments gradually made for houses and barns, for live stock and pastures, for tools and implements, for roads and bridges, succeeded in squeezing immediately a surplus revenue from the virgin soil?

Again, do you know of any mining operation, of any railroad—in fact, of any business—which, from the moment of its original organization on, did not require for a number of years investments in addition to the mere acquisition of real properties, before the aggregate of the investments was placed on a permanently remunerative basis?

We can not expect in American business forestry to be wholly exempt from handicaps which naturally beset every start in business abroad, where the Austrian Government struggles over the initiation of forestry in the primeval vastness of the Carpathians, as well as in this country, in spite of our (possibly just) claims to greater than European business sagacity.

At Biltmore we are masters of the situation only now, since we have succeeded in consolidating the tract by gradual purchase of four hundred and sixty-four interior holdings; in acquiring access to the nearest railroad, with loading stations of our own; in training foreman and workmen for a novel task, for the new idea of conservative use of the forest.

The additional investments—additional to the land purchase—consist in the main of the following items:

(1) Permanent roads, by which our farms, our pastures, our mines, our tan bark, and, above all, our trees, are made accessible.

Logging by railroad is unadvisable, owing to the roughness of our mountains, the steep grades, and sharp curves necessarily required.

We bring the mills—portable mills—to the trees, so to speak, instead of carrying the trees to the mill. The slabs, the sawdust, and the tops are left as waste in the woods. Indeed, we "waste the timber," wherever waste pays best, in our judgment.

(2) Over a thousand miles of trails have been built to facilitate fire protection, exploration, management, and sport, at an expense varying from \$5 to \$40 per mile.

(3) Our workmen are, as far as possible, resident tenants. We provide them with villages, gardens, lots, cow pastures, schools and churches, and rural mail delivery. It is my chief aim to attach my helpers to my task—to *their* task; to give them the chances at education, at religious functions, at pleasures which the backwoods usually fail to afford, the desire of which drives the mountaineer to the doubtful dorado of city life. These village settlements, in addition, give us the possibility of a home market for firewood, for the minor qualities of lumber, for beef and mutton raised on our pastures.

The farms, on the other hand, are meant to supply our lumber camps with food for man and beast.

(4) On fertile land, along the streams, the forest is annihilated and the soil converted into farms leased to our tenants. These strips of farms form fire-



lanes which even a severe blaze will not traverse. The farm boys during winter join the crews of wood-cutters. The members of the farm family act as forest guards free of charge.

(5) Our stock pastures are invariably kept under fence. The majority of the stock pastured belongs to outsiders, who pay the monthly fee of fifty cents per head of cattle and of ten cents per head of sheep. Often we use the cattle, previous to and after lumbering, to eradicate the forest weeds injurious to the reproduction of Oak, Chestnut, and Yellow Poplar, which we raise from seed left on the ground by the removed mother trees.

(6) Suitable slopes we plant in apple orchards—on a small scale only—induced to make the experiment by the good name which western North Carolina fruit is recently acquiring in the apple-eating world.

(7) From two small hatcheries attended by the rangers we stock our streams with trout. During winter we

provide food for deer, turkey, grouse—all with a view to increase the stock of fish and game. To give an idea of the financial possibilities of this minor source of revenue, I want to say that we are just considering the proposition of a northern club desiring to lease the hunting and fishing privileges of 60,000 acres of forest at an annuity of five thousand dollars.

(8) The case of abandoned farm land excepted, we do not think it advisable so far to plant any tree seedlings on the areas logged over. We know that nature, for thousands of centuries, has succeeded in raising, by her own means, a progeny of second growth over the decaying corpses of her dead tree children. We merely facilitate nature's work by way of "weeding," securing for a *large* number of nature-planted seedlings a fair chance of development. The weeds of the forests, the kalmias, the halesias, the vaccinia, the ferns, and, above all, the misshapen, low-crowned, stunted, dwarf growth of



A CUTTING ON THE BILTMORE ESTATE.

oak and chestnut hinder that development. We make it a rule to invest, for weeding purposes, 10 per cent of the gross receipts obtained from the sale of mother trees.

We never remove any mother trees without definitely aiming at the propagation of a second growth.

I need not say that the work in nature, with nature, and, in a certain sense, for the public good gives the forester a great deal of satisfaction—satisfaction which a more remunerative office occupation could scarcely secure. I know full well that I shall never see the fruit of my labors. The seedlings

and saplings raised under my fostering care will not be able a hundred years hence, when they are ready for the axe, to tell my successor removing them of the tender love with which I have brought them into life and protected the early days of their childhood. What I hope for, piously hope for, however, is that the young men studying forestry at Biltmore, at my Biltmore Forest School, will further propagate the ideals and ideas of true forestry—forestry securing the continuation of the forest by proper business-like development and proper business-like use of all forestal resources.

## CRANBERRY CULTURE.

THE GROWING OF THIS CROP REQUIRES A PECULIAR KIND OF IRRIGATION AND HAS MANY OTHER INTERESTING FEATURES.

BY

BRISTOW ADAMS.

JUST at this time of the year, when thoughts of Thanksgiving turkey and pumpkin pie are uppermost, there appears in the markets the glossy cranberry, another strictly American product, and a necessary concomitant of the aforementioned feast day. To the housewife the cranberry is known simply as a source of sauce, and one which takes a great deal of sugar, yet has the redeeming quality of being almost invariably sure to "jell." But before the housewife gets the cranberry there must be a long development of the plant and care to the conditions under which the fruit comes to maturity.

Cranberry growing is an important industry, and furnishes an example of one of the few indigenous American fruits which has been developed into a commercial commodity of note. The industry is not a new one, though new methods are coming into use, and scientific effort is being expended in the cranberry grower's behalf. Even now there is a publication devoted to his in-

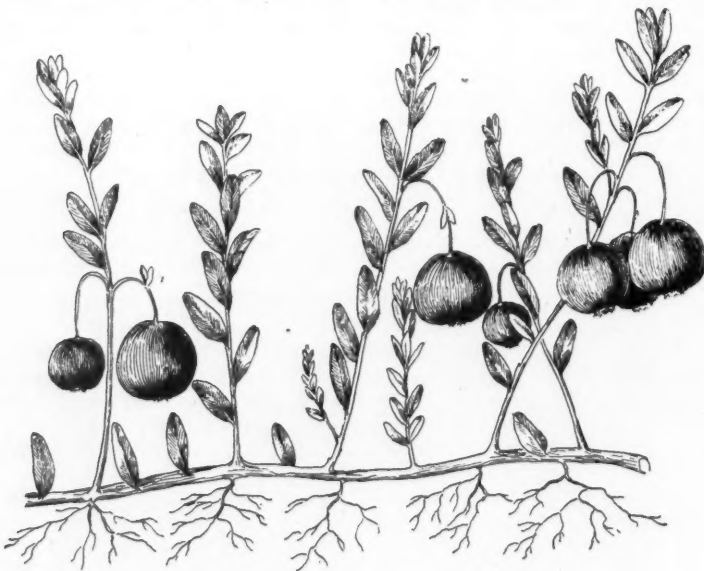
terests, *The Cranberry Grower*, published at Cranmoor, Wis., and edited under the auspices of several associations whose interests are closely connected with the cranberry supply and demand.

The cranberry belongs to the well-known botanic family, the *Ericaceae*, which includes the heaths, and one of its near relatives is the huckleberry. Webster's Dictionary, on the authority of Dr. Prior, says that the berry gets its name from the fact that it ripens in the spring, when the *cranes* come. The name may come from the fact that berries grow in bogs which cranes frequent. There is a coincidence in orthography to indicate some relation between *cran* and *crane*; there is also the trifling argument that the berries do not ripen in the spring at all, and are rather late fruit among the autumnal varieties. This late ripening is as true of the English berry as it is of the American, so we can hardly put credence in the dictionary's definition. The European berry is small and in-

ferior to the American berry in every way, though it is used in culinary science, and "cranberry tart" is a treat to the Briton. The European variety is known as *Vaccinium oxycoccus*, and is indigenous to subarctic and Alpine swamps in Europe and America. The larger variety, *Vaccinium macrocarpon*, is known to grow only in this country, and while these two are the only recognized species, there has lately been an attempt to subdivide the latter into several distinct improved varieties.

The plant itself is a low creeping vine,

berry would prove profitable have turned out failures. Such failures are expensive, as the first cost of a cranberry bog is a heavy one. One rule only can be relied on with any certainty, and that is that the berry will be apt to grow where it occurs naturally and where topographic conditions lend themselves to the problems of drainage and flooding, which must be taken into consideration. Thus the commercial cranberry bog must combine the natural conditions with all possible safeguards against adverse ones.



HABIT OF GROWTH OF THE CRANBERRY.

on which the fruit is borne on upright shoots of one-year's growth. It occurs naturally in many states of this country, from Maine to South Carolina, but in warm localities only in high altitudes. The western lake states have many bogs where the fruit grows naturally, and in this section the greatest efforts are being made toward the improvement of the berry. But it will not grow everywhere and not always where every condition seems favorable. Many disappointments have resulted from unwise ventures, and even those where it might have been supposed that the cultivation of the

The question of soil is an all-important one. While the cranberry is not a water plant, it thrives best on soils in which the water level is within a few inches of the surface. This soil should be of an alluvial nature and of the kind commonly known as peat or muck. In connection with this soil condition there must be an easily available water supply and a readily accessible supply of sand. These three conditions are not in themselves hard to assemble, or to find already assembled, but in addition the bog must be in a high latitude or high altitude, and it is necessary to realize this thoroughly.

For example, there are some commercial cranberry bogs in Washington and Oregon which are paying investments ; but this does not argue, as some suppose, that the industry can be established on the lower Sacramento River, where all conditions of soil and drainage are perfect, but where the climate is not at all suitable. At present the important commercial cranberry bogs are in Massachusetts, New Jersey, and Wisconsin. There are minor areas in Connecticut, Illinois, Indiana, Iowa, Kansas, Maine, Michigan, Minnesota,

berry vines. Most of the work has to be done by hand on account of the boggy nature of the ground, and long experience has taught that this must be the case from the start to the harvesting of the crop each year. After denuding the ground of its plant growth, it must be made level, so that the water will stand at a uniform depth below the surface of the soil and in order that the meadow may be flooded evenly and with the minimum amount of water. Then there must be precautions taken to have a sufficient supply of water to flood all



A WELL-KEPT CRANBERRY MEADOW ; VINES SENDING OUT RUNNERS.

Nebraska, New Hampshire, New York, North Dakota, Oregon, Rhode Island, Washington, and West Virginia. Several possible areas for the cranberry have not yet been developed commercially.

The first thing requisite in preparing a cranberry bog is to "scalp" the ground absolutely free from all plant growth, from trees down to the smallest grasses. After the larger growths are removed, the top layer of soil to the depth of several inches must be taken off in order to destroy the crown and roots of all plants which would prove troublesome as weeds among the cran-

the cultivated area in a short time. The meadow itself must be diked to hold this water and must have ditches and gates to carry off the flood and any excess waters.

It can be seen that the irrigation operations are essential, and that every care must be taken to have these work properly. After the surface has been graded, the soil given a thorough cultivation and compacted, the meadow is ready for sanding. This means the covering of the cultivable area with a uniform depth of sand, free from clay or weed seeds, to a uniform depth of three or four inches. In some places

the sand is hard to procure, and the fact that it generally has to be applied by hand labor makes this operation one of the most expensive in connection with laying out a new plot. However, this sanding is of such importance in the subsequent growth of the plants that it must be done carefully and thoroughly.

Propagation, with the exception of that for originating new sorts, is done by slips or cuttings. In its natural state the plant propagates by offsets. Commercial plantings are generally made with cuttings about a foot long, which are dibbled into the ground in rows at regular intervals by a pressure in the middle of each cutting. This planting should be done in the spring, as early as plants may be secured, which is generally about June 1, as the bearing meadows from which the cuttings must be secured are usually kept flooded until after the middle of May in order to secure the crop from frost. Cultivation is almost wholly connected with preparing the soil before planting the cuttings. After planting, the great necessity is to keep down weeds, and here hand-pulling must be relied on.

Flooding is the all-important consideration in cranberry culture, for by it the blooming of the plants is retarded until the last killing frost is past. In addition to this, there is also the benefit to be derived from the use of water as a prevention against the heaving out of the plants by repeated freezing and thawing. It has also been established that some insect pests can be coped with by timely flooding. The great care required in cranberry culture finds its exercise at the time of flooding. The thermometer must be watched, local conditions considered, and many times a wakeful and watchful night must be spent at the bog to guard against a sudden lowering of temperature, requiring an immediate turning in of the water, to prevent a freezing of the plants. Moreover, when the bog is coated with ice from one flooding, great care must again be exercised to prevent an accumulation of water from heavy rain or from a thawing, which will raise the ice surface of the flooded area, the ice itself taking with it the plants

which are frozen fast to it. The Weather Bureau stations in the vicinity of cranberry meadows lay particular stress on prognostications for the benefit of the growers, and their forecasts have saved many dollars and are becoming more and more to be relied on.

During the summer there must be some precautions against insect enemies, and various insecticide sprays and dry powders have been found of value. In this, as in the flooding, watchfulness is the key-note, and the grower who is ever alert makes a success of his plantation, while he who plants the vines and leaves them to "jes' grow" like the inimitable "Topsy," generally makes a failure of it, and is responsible for the many examples of loss in the business.

Harvesting commences much earlier than the consumer imagines, as the berries are not generally marketed until the Thanksgiving season—a condition made possible by their keeping qualities. Some growers insist that the fruit will remain perfect for a year if it is carefully selected and handled in the first place. The picking season generally begins about September 15, and sometimes a little earlier, and is at its height during the first week of October; for though they require a cold climate, frost is to be feared at both ends of the season, when the plant is in blossom and when it is in fruit. The crop is generally hand-picked, though a scoop with a comb-teeth bottom is sometimes used to strip the branches. There is some objection to this, although it greatly facilitates picking, on the ground that it tears the plants up too much. The pickers are generally women and children, and are paid by the measure. As the berries come from the field they are assorted, after being winnowed to free them from leaves and sticks. The assorting is sometimes done by hand, but a table over which the berries roll and drop into suitable openings, much as potatoes and apples are graded, is in general use. Three grades are recognized; the "jumbos" or selects, next the "standards," which are most commonly seen in the markets, and finally the small or "pie" berries, which are



inferior in appearance, but are in demand generally on the presumption that they are sweeter than other kinds.

The berries are generally marketed in barrels after having been stored for some little time, the only precaution in the storing being to protect the produce from frost. They sell at about \$8.50 per barrel, though there has been a wide range in prices in different years, from \$4 in 1870 to \$16 in 1874, the extreme years. Last year a barrel brought from \$10 to \$12 on the New York market, and the prospects are that this year the prices will be about the same. The

creased more rapidly than at present, and in spite of the fact that cranberry sauce is inseparably connected with turkey in the public mind, there are still three-fourths of the homes of the country into which the berry does not enter, a condition which ought not to exist when the shipping qualities of the fruit are considered. Attention must be called to the desirability of the fruit for many purposes besides jelly and pie. The housewife must be disabused of her notion that there is a waste of sugar, by arguments that the food value of the sugar is not lost, and that the quantity



MEADOW LAID OFF FOR PICKING, WITH PICKERS AT WORK.

annual yield averaged in recent years about 1,000,000 bushels, and has gone as high as 1,300,000. This year will fall below the average on account of late June frosts in the principal cranberry districts of the East, and the general estimate is for a crop of 850,000 bushels, divided as follows: New England and Long Island, 400,000; New Jersey, 350,000, and the West, 100,000.

In spite of the fact that cranberry culture in this country is a century old, still it must be admitted that as a commercial venture, judged by modern standards, the industry is still in its infancy. Acreages could well be in-

creased. Growers also must put up as carefully harvested and handled a berry as possible, for ten barrels of bruised fruit do more to glut the market than one thousand barrels of carefully selected berries, especially if they go at the beginning of the season and give the trade the idea that the berries are not going to keep well during that particular season. At present the greatest future for the cultivation of cranberries lies in the West, where all locations are not yet taken up and where improved methods are being more rapidly introduced.

## COURSES IN FORESTRY AT AGRICULTURAL COLLEGES.

BY

SAMUEL B. GREEN,

PROFESSOR OF FORESTRY, UNIVERSITY OF MINNESOTA.

FOR about fourteen years we have taught the subject of forestry in the University of Minnesota, but until recently we have had no special course in this subject, although we have offered seven terms work in it. I have purposely withheld from advocating a course of this kind, for I felt that the only places open for our graduates would be in the government service, and it seemed to me that it was not wise to train students for no other opening; but now I am thoroughly convinced that there is going to be a demand for trained foresters by private parties. I believe it is the duty of agricultural colleges to introduce this subject into their courses, for the reason that they are nationally endowed for the express purpose of giving education in matters pertaining to rural affairs, and their courses can be easily adapted to forestry.

We all agree as to the importance of having the American forester a practical man of affairs. He must show that forestry is a business that is entitled to the respect and consideration of private individuals as well as the government. He must make it pay, and to do this he must be able to use the land in his charge for its utmost profitable production; in other words, he must be a versatile man, for he will have to face a thousand natural problems at first hand. It is very certain that he will have many agricultural problems in addition to those which are purely of a forestal nature. In every large forest range there is always more or less land that is better adapted for farming than for anything else, and it may be well also to introduce such agricultural industries as pasturing, dairying, and the raising of hogs, sheep, and horses. Having all of these industries included in a forest range will have a tendency to give em-

ployment to a large number of men throughout the growing season, and these will be available for emergencies—as, for instance, in preventing forest fires. Besides, farming lands make excellent firebreaks.

The agricultural colleges, it seems to me, offer the best of opportunities for the training of men for rural life of any description, and they and the experiment stations of the different states are generally in very close touch with the farmers. Students with the training that is given in the best agricultural schools and colleges understand the possibilities of rural life, and this will be an important feature in the education of the future forester, for he must be a man who will be eminently helpful in rural affairs. He will often be isolated and have to associate with those who are rather below him in the social scale. He will have to direct, more or less, the political matters in his neighborhood if he is to be successful in solving the problems connected with the administration of a large forest reserve. The best way to gain the confidence of the people of any section is to help them in their work, and a man that has this agricultural-college training should be most helpful in a rural community. In fact, to be thoroughly useful a forester must have in him a full desire to be helpful. Not only must a forester be in love (so to speak) with his business, but he must be one who is content with the pleasures of country life. He can not go to the city for his pleasures. He must find them in his rural surroundings. I believe that the most successful foresters of the future will be largely those who have been brought up in rural surroundings and understand their possibilities.

Let us glance for a moment at what

our best agricultural colleges teach. I have referred to the problems in connection with animal industry, and to the growing of crops, and to these subjects the agricultural colleges pay special attention. Then there is the subject of plant propagation and horticulture. A knowledge of these matters will be valuable to our forester, as he will very likely be concerned with the raising of seedling trees; and he should also be a good gardener. It is quite possible, as Dr. Schenck stated to me recently, that the forester may have problems in fruit growing, as he has found it desirable to plant orchards on some of the forest lands on the Biltmore estate. Botany as now taught in our best agricultural colleges is a study of plant life in health and disease, and not only the study of the more evident characteristics of plants that are necessary to identify them. Such a study is most helpful and practical for any one who has to do with plant life. Veterinary science is a subject in which our forester should have some training, and a course in veterinary medicine, anatomy, and surgery would make him independent of his stable men and teamsters in many matters which would make for profit. Then, too, such a study will be helpful to him in caring for his men, to whom very likely he will have to be a sort of father in sickness and in health, and he may have to do occasionally some work in minor surgery. The entomology in our agricultural colleges is easily adapted so as to make it forest entomology, and it is a most valuable subject for the forester to understand. Land surveying is especially desirable. Blacksmithing and carpentry work are also taught in our best agricultural schools and colleges, and I believe that such practical training would be eminently helpful to our forester, who will be very likely far removed from specialists; not that it is any great credit for a man to know about such matters, but an acquaintance with them may make him much more efficient. It may save him, for instance, from going a long distance to get a pitman rod welded, or the fact that he can make a link or a hook for a chain may often save him a

large amount of time. He should certainly know enough about wood-working to know the difference between a splitting saw and a cross-cut and how to file and set them properly. He should also know something about the general principles of the construction of dwellings and other simple buildings.

A knowledge of accounts is very desirable, for the very keystone of his work is business. The most helpful kind of physics for him to study is what is known today as agricultural physics, which teaches the properties of the materials with which your rural man of affairs will have most to do. All the subjects mentioned are given in our agricultural colleges.

In laying out a forest course in agricultural colleges we should aim to make it rest upon a business basis. A mere sentimental or theoretical form of teaching in forestry can not take the place of that which I have in mind as desirable for a forest course. In my experience with farmers' sons I have found that they were especially interested in subjects that have a direct bearing upon the every-day affairs of life, and that it is hard to interest them deeply in sentimental or esthetic or merely theoretical matters. On this account I would have the subject of forest mensuration introduced early in the course, that it may show to the students the relation of forests to financial results. This instruction should be supplemented early in the course by experience in logging operations.

In order to make a strong forest course in any agricultural college, there must, of course, be a professor of forestry who is in close touch with forest conditions and interests. I do not care to discuss now what his duties should be, but my object in this paper is to show what I believe to be a fact, that the American agricultural colleges are the best fitted of any class of educational institutions to give the sort of education that the foresters of this country are going to need most.

It seems to me that the forest situation in this country will never be on a thoroughly practical basis until we have convinced our farmers that it is a prac-

tical affair. Most of the farmers of this country will be foresters—to some extent, any way—and are so today. The agricultural colleges of this country are especially fitted to reach this class of our citizens, and they can do an immense amount of good by introducing

this subject into their courses. It seems to me that institutions which have been so well endowed by the national government as they to meet special educational needs should undertake this work which will make so much for the public welfare.

## AN INTERESTING PHASE OF GERMAN FORESTRY.

HOW A BADEN FORESTER IS IMPROVING CERTAIN VILLAGE FORESTS.

BY

AUSTIN CARY,

FORESTER TO THE BERLIN MILLS COMPANY.

THERE are many American foresters who will welcome fresh news from Oberförster Karl Philipp, of Sulzburg, Baden. In addition, the condition of his *Bezirk* (range) is so interesting in many ways that a brief description of it may be of service.

Herr Philipp, who was first known to some of us as assessor at Herrenwies, received his appointment as oberförster in December, 1897. Repairing to Sulzburg, he found a district very poorly developed, part of it, indeed, a good deal neglected. No adequate road system was in existence, and the proper amount of wood had not been cut for years. Thinnings had not been properly attended to; regeneration had been secured and then neglected; timber had been allowed to stand till it was diseased and too old to reproduce.

In consequence of this the woods at Sulzburg presented, and they present yet, a very irregular appearance, one that Americans do not naturally expect to see in Germany. Herr Philipp himself calls some of his stand an *Urwald* (primeval forest), but that as a term of reproach is not really deserved, because actually dead or uprooted timber has at all times been taken out. The forest, however, is largely overstocked with mature wood, its condition imposing a burden on the manager entirely out of

proportion to its area. However, it may be all the more instructive to students as presenting a liberal illustration of how things should not be done.

The area of Sulzburg forest is about 5,300 acres. The road system being put in will comprise when completed about 40 miles of stone-bottomed road at a cost of something like \$125,000. The development of the system will extend over a period of fifteen years, and is being put in according to the prevailing Black Forest system, around the shoulders of the mountains and valleys on easy grades, rather than directly up the valleys. These main roads are supplemented with permanent drag roads and slides, so that the average distance from stump to road is under 200 yards. By means of the roads the current expense of wood transport within the forest has for some districts been already reduced more than one-half.

One of the first things that Herr Philipp struck for was a heavy cut in order to utilize the overgrown and defective wood and to bring about much needed thinnings. Here, strange to say, he met with opposition from the inhabitants of the villages who own most of the land he has to manage, they being possessed of what we had supposed was the peculiarly American idea that the only thing to do to a forest is

to preserve it. To get round this obstacle he stirred the people up with ambition for public improvements. One village might well have a new court-house, and this need was skillfully presented with the suggestion that the woods could well pay for it. In the same way new school-houses were provided for in other communities, while improved streets and water works have been introduced into several. It was amusing indeed to hear Herr Philipp tell how he had by various ways stimulated the ambition for public improvements. He said he did not mean to stop until a library was introduced into each of the thirteen communities whose woods are in his care.

Here, as elsewhere, every village has its forest, ranging from a few hundred acres to many thousand, often so productive that they meet all municipal expenses.

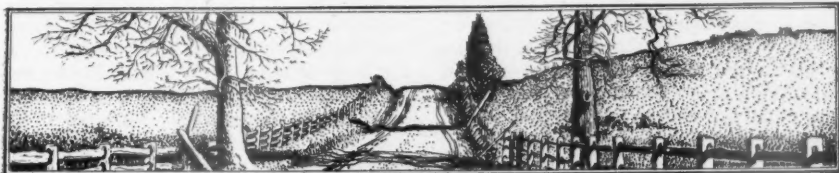
On the 5,000 acres of forest under his charge Herr Philipp is now cutting about 160 cubic feet per acre, admittedly more than the yearly growth, but the condition of the forest demands it. Such of the old stands as are too old now to regenerate naturally are being cut clean in small areas and planted. Natural regeneration, however, under the middle aged stands of Fir, Beech, and Oak, is very abundant almost everywhere in his district.

One peculiarity of management noted was the unexpectedly heavy thinnings. At 40 to 60 years of age the trees of the final stand are carefully selected by Philipp and given plenty of room for full development. Even considerable breaks in the leaf cover are not regarded. They fill up quickly in the younger stands, and any time after 80 years of

age bunches of advance growth are considered desirable and are protected. Professor Graves reports that throughout Germany such minor soil exposure is coming to be considered of less and less importance.

The principal tree at Sulzburg is, of course, the Fir, which reaches an excellent development and reproduces very freely. Beech forms 20 per cent or more of the stock and is welcomed as a mixture in about that proportion. Oak is abundant in the warmer places, and there are some good stands which present in a small space a great variety of silvicultural conditions. There is Oak, pure and in various mixtures; Oak with undergrowth of Beech, of Fir, and of bushes. Herr Philipp, however, thinks that Oak is becoming less profitable as a forest crop. For his locality he believes in Fir, in Beech for mixture, in the planting of Larch, White Pine, Douglas Fir, and a few other exotic species for variety in product and appearance.

The average net revenue derived from this district for the last five years is nearly \$8 an acre. In Sulzburg itself each adult male inhabitant and each widow receives yearly about \$17 of revenue from the forest, which, as a rule, vastly overbalances their local taxes. In addition, the town has been lighted with acetylene gas, has built a court-house, has put in water works, and subsidized a local railway. These special expenditures altogether amount to about \$65,000, and the forest is expected to pay for them within ten years. In all there are thirteen villages and about 8,000 people interested in these 5,000 acres of forest.





## FLOOD PREVENTION IN INDIANA.

SOME PRACTICAL EFFORTS THAT ARE BEING  
MADE TO PREVENT DISASTROUS OVERFLOWS.

BY

C. J. BLANCHARD,

UNITED STATES GEOLOGICAL SURVEY.

SERIOUS consideration is being given to a project which has in view the diversion of part of the waters of Kankakee River to Tippecanoe for the purpose of doing away in part with the effect of disastrous overflows. In Indiana the exceptional fertility of the areas of swamp lands reclaimed by drainage ditches and of the bottom lands protected from destructive overflows by dikes is fully recognized. During the past few years enormous sums of money have been spent in the state in expensive drainage works and in throwing up dikes and levees to prevent the usual spring overflows. The results in nearly every case have amply repaid the investment.

A preliminary investigation just completed by Edward Johnson, Jr., assistant engineer of the U. S. Geological Survey, shows that such a diversion is feasible at two points—first, at a point 7 miles east of Knox, in Stark county, on the Yellow River, which is a branch of the Kankakee, and where the water may be diverted to a point one-half mile south of the Tippecanoe, near Oro, in the southeastern part of Stark county. There are numerous ditches constructed through this section for the better drainage of the land. The watershed between the Yellow and Tippecanoe rivers is found at a point 2 miles south of Yellow River, and from this point within a few rods of each other are ditches which run north and south respectively into each river. From accurate profiles of these ditches it was found that the Tippecanoe at the point mentioned is  $16\frac{1}{2}$  feet lower than the point selected on the Yellow River. The watershed is only from one-quarter to less than one-half a mile, and the connecting canal would not have to be very deep. The natural course followed

would be the line of the ditches known as "The Hackler," running north, and Williams and Osborn ditch, running south.

Considerable straightening of Yellow River has been done. From a point 7 miles east of Knox to its confluence with the Kankakee it has been either straightened or made to follow a better defined course. Its fall is about 4 feet to a mile, making a total fall in this distance of about 50 feet, and a fall of about 20 feet from a point at which the canal would enter it to Spring Creek, which is a tributary of considerable importance entering it about half way between Ober and its outlet. Diversion at this point, however, will not be recommended for the reason that no great quantity of water would be diverted from Kankakee River to the Tippecanoe by a canal at this place. It would simply mean diverting the water of Yellow River above Ober, which is not of considerable importance, an estimate of the discharge on August 28 being only 40 second-feet. Further, there would be considerable objection to this plan by the residents of Knox and the property-owners adjacent to Yellow River. The straightening of this stream has done away with the disastrous effects of overflow and the stream is now the natural outlet for the future sewage system for the town of Knox.

The second point would connect directly with Kankakee River at a point north of North Judson and run south to the large Monon Ditch, which flows into the Tippecanoe 8 miles north of Monticello in White county, following the course of the Monon River. This canal would carry a large quantity of water to the Tippecanoe, as the Kankakee is a stream of considerable importance. It

would also drain much desirable land in Stark and Pulaski counties.

A large sum of money is being expended on the straightening of the Kankakee River for 30 miles through Stark county. This is doing away with a great deal of the overflow of the adjacent lands, but a canal to the Tippecanoe would materially increase its beneficial effects. The natural course of this canal would be that of the Stauffer and Burbank ditches. The former starts

a few miles south of North Judson and runs north into Kankakee River, while the latter starts at nearly the same point and runs south into the Monon Ditch. The preliminary examination indicates that it is possible and feasible to connect the Tippecanoe and Kankakee rivers at this point, and a thorough investigation would repay any person who is directly interested in the adjacent farm lands on the Kankakee or in the water power of the Tippecanoe.

## DEFEATING THE HOMESTEAD IDEA.

BY

WILLIAM E. SMYTHE.

FOR more than forty years the phrase "Homestead Law" has been pleasantly familiar to American ears. It opened a way for millions of people to get a foothold upon the land. The idea was that as long as there was any portion of the public domain fit for agriculture, and not otherwise appropriated, any citizen, or even any alien who had declared his intention to become a citizen, might obtain 160 acres of it by filing his claim, and paying certain nominal fees, and settling upon it to make his home in good faith.

It was a beautiful act of paternalism—Uncle Sam, the rich and loving father, dividing his estate among all his children, natural and adopted. And the plan worked as beautifully as it sounded, so long as there were farms to be had in that part of the public domain which receives a good natural rainfall. Practically the last of such land has now passed away from the government. There is a vast empire yet left—an empire in which tens of millions will some time dwell—but every acre of it must be irrigated before it will be fit for homes. When this is done, one acre will be equal in productive capacity to 4 acres depending on rainfall.

### TO BUILD A HOME.

The central thought in the Home-

stead Law, as the name implies, is that a family should settle down to the enjoyment of an independence from the permanent tilling of the soil. When it is used for any other purpose it becomes a misnomer and a disgrace.

The law sought to make sure of the permanence of the settler's home by providing that he should live upon and cultivate his homestead entry for five years before getting final title. If a family could remain that length of time on a quarter-section, it would certainly become established and attached to the soil. In the view of the lawmakers, neither less nor more could be asked as a demonstration of good faith.

But the commutation clause goes very far to nullify this wise provision of the law in regard to a five years' continuous residence and cultivation. Under this clause, title may pass to the settler at the end of fourteen months, on payment of \$1.25 per acre.

### CHANCE TO EVADE THE LAW.

The commutation clause is entirely unnecessary to the settler who intends to comply in perfect good faith with the letter and spirit of the Homestead Law. While it would be going too far to say that no one has ever availed himself of this means of shortening his residence upon the land for a worthy purpose, it

is a fact that the method is chiefly useful to those who wish to evade the real intent of the law.

There is a great struggle for valuable pasture lands in the West. The country continues to grow, and with it the demand for beef and mutton. The public pasture available for live stock does not grow, but becomes relatively less. Stockmen see the shadow of coming changes in land laws, when they will no longer be able to use the range without restrictions and without price. Naturally enough, they desire to make themselves secure in the possession of as much good grazing land as possible. There is a way in which this may be done, and this is by means of the Homestead Law and convenient "dummies" to make entries under it.

#### HOMESTEAD ENTRIES OF TODAY LARGELY FRAUDS.

As the law requires actual residence, it is desirable to have the required period as brief as possible. Residence upon it is usually nothing more than a "bluff." A claim shanty is erected,

and the owner does well if he sleeps there as often as one night in six months. Five years' residence would give title for a nominal price, but the claimant would rather commute after fourteen months and pay \$1.25 per acre. Having obtained title, the entryman can immediately sell his land to any one he chooses, which is frequently the individual or corporation for whose benefit his filing was really made. In such cases the money has been advanced by the interested parties, while the man who has loaned his rights of citizenship receives a modest stipend for the accommodation. Considered as a home-making proposition, the whole proceeding is a farce.

The Homestead Law is all right, but the commutation clause is all wrong. The honest settler does not need it, and the country does not need the other kind of settlers. The President has urgently demanded the repeal of this feature of the law, and, backed by an enlightened and insistent public opinion, his advice ought speedily to carry with Congress.

## OWENS RIVER VALLEY.

ANOTHER SECTION OF CALIFORNIA THAT IS  
BEING STUDIED BY THE RECLAMATION SERVICE.

A REPORT on Owens River Valley has been submitted to the Chief Engineer of the U. S. Reclamation Service by Assistant Engineer J.-C. Clausen, who was detailed to make a reconnaissance to determine the amount and quality of the arid public lands and to investigate the possibilities of water storage for their reclamation.

As a result of the primary investigations, it was found that the valley is about 100 miles long, with an average width of about 5 miles. About 200,000 acres of this area has passed from government control, and it is estimated that 60,000 acres still under government title can be reclaimed at a profit. It is further estimated that 50,000 acres of good land belonging to private parties

is now worthless, owing to the absence of water. The soil is of granitic character, due to the wash from the adjoining mountains. After a thorough investigation of the land had been made, investigations were made for a possible reservoir site. This was found at the lower end of Long Valley, in the southern part of Mono county, Cal., on the Owens River, at an elevation of 7,000 feet. A survey is now being made of this reservoir site, and although no definite figures as to the capacity and cost of construction can be given, it can safely be said that the storage capacity is ample for the problem in hand. The water-shed tributary to this site has an area of about 300 square miles, having an elevation of from 7 to 12 thousand

feet and nearly all subject to a heavy fall of snow. A 110-foot dam would have a crest length of 450 feet and a base length of 175 feet. Bed rock occurs at both abutments. This rock is of volcanic origin, very light, weighing not over 100 pounds per cubic foot, and to a certain degree porous. Sufficient quantities of it for construction are in the immediate vicinity of the dam site.

The water supply is also being thoroughly investigated, and a preliminary gaging station has been established on Owens River above its junction with Rock Creek. Frequent meter measurements have been taken and daily gage heights observed.

Stations have also been established on Rock Creek, Pine Creek, and Bishop Creek, and measurements are being taken on all streams tributary to Owens River. Owing to the limited records, nothing definite can be said as to the probable quantity of water available for

storage. Private capital has quite extensively developed irrigation in the valley by the construction of some fifteen canals of varying capacities of from 100 to 2 second-feet, and in order to determine the quantity of water required to satisfy existing rights, it was necessary to establish gaging stations on each canal. To obtain all data required for the intelligent decision as to the possibility of the reclamation of land in the Owens Valley will not only require completion of the work now under way, but it will be necessary to map the present irrigated land in order to determine the duty of water and the existing private rights, to make preliminary canal surveys, to reestablish government lines so as to determine accurately the quality and quantity of land actually belonging to the government, and to make surveys of the lakes in the high Sierras with the idea of making them features to the larger system.

## RECENT PUBLICATIONS.

*Any of these books will be sent by the publishers of "Forestry and Irrigation," postpaid, to any address on receipt of the published price, with postage added when the price is marked "net."*

**The Land of Little Rain.** By MARY AUSTIN. Illustrated by E. Boyd Smith. 8vo. In a box, \$2.00 net. Houghton, Mifflin & Co., Boston.

In Mary Austin's "The Land of Little Rain" the public gets another notable book on outdoor life. Its title aptly expresses the dominant characteristic of the great silent section of country of which it treats. The volume is made up of a series of sketches of the human, animal, and plant life found in the region of the Mojave Desert, Death Valley, and the Sierras, much of which the average person is likely to consider almost devoid of living things. It is such a book as only a resident and lover of that lonely region could write. On the one hand it suggests John C. Van Dyke's picturesque book, "The Desert," and on the other John Muir's admirable volume, "Our National Parks." Like the authors of those books, Mrs. Austin has a love for nature that amounts to a passion. Unlike them, she does not stop with only describing plants and animals and scenery, but includes descriptions of Indians, greasers, and the many odd characters of a corner of our country where life is still unconventional and where types like those made immortal by Bret Harte are still found. Added to an intimate knowledge of and sympathy with the

life she depicts, Mrs. Austin writes in a most charming manner. Her style is clear, pure English, which carries the reader along. It seems in every way a book from the heart. The art features of this volume deserve special notice. There are a large number of full-page and marginal drawings by E. Boyd Smith that greatly heighten the value of the book. He is acquainted with the scenes depicted, and has done much to embellish a book that must take a high place in our literature on outdoor life.

**The Forest.** By STEWART EDWARD WHITE, author of "The Blazed Trail," "Conjuror's House," etc. With 18 full-page drawings, one of which is in color, by Thomas Fogarty. \$1.50 net. The Outlook Company, New York.

One of the latest, and in many ways one of the most valuable, books on outdoor life that has been published is Stewart Edward White's "The Forest." Two years ago Mr. White won wide recognition as a coming writer of force in his novel, "The Blazed Trail," which contains an unusually accurate description of life in the great lumber regions of the Lake States. This book touches a field almost new to fiction writers. His new book, "The Forest," is a series of chapters on life in the woods, in which

fact and fiction have been combined with a literary art and knowledge of men and nature which will appeal to all who love outdoor life and well-told stories of adventures. The author writes from many years of experience in woods life. The thread on which the chapters of the book are strung is the story of a thousand-mile canoe trip through the wilds of northern Michigan and Canada. In addition to stories of experiences and adventures on the "long trail," there are practical instructions in woodcraft, sketches of the habitants and the woods Indians of the Canadian provinces, and genial philosophizing on many of the phases of life in the great woods. The titles of some of the chapters will indicate the great variety of the author's treatment of the subject: "The Science of Going Light," "On Lying Awake at Night," "On Open Water Canoe Traveling," "On Flies," "The Catching of a Certain Fish," "The Forest" is beautifully illustrated with a number of full-page drawings, one of which is in color, and decorations by Thomas Fogarty, a personal friend of the author and his companion on the trip in question. It is not only a record of journeys and adventures and people met in the great north woods, but for hints on camping, canoeing, and general woodcraft it will rank with the best guides on these subjects. We have no hesitancy in saying that "The Forest" is one of the most entertaining and useful books on outdoor subjects that has come to our notice. In addition, from cover to cover it is one of the best examples of book-making that we have seen. It is in every way a notable book in its special field.

#### **Ferns; A Manual for the Northeastern States.**

By DR. CAMPBELL E. WATERS. With over two hundred illustrations from original drawings and photographs. 8vo. Pp. 362. Henry Holt & Co., New York.

Of our wild plants and flowers none attract lovers of nature more than the ferns. For this reason Dr. Waters' recently published volume on "Ferns" should meet with a welcome reception. It is a popular, though scientific, work, the result of fourteen years' careful study of the ferns of the northeastern states. The book is not a compilation from other works, but contains the results of general observations and special studies in the field, and should be of great value to amateur and professional botanists. The reproduction and classification of our northeastern ferns are treated in separate chapters. There are analytical keys based on the fructification and stalks of ferns, followed by a description of the various species of the leading families. A valuable chapter is that devoted to fern photography.

In the matter of illustrations this volume is unique. There are more than two hundred excellent half-tones from photos and drawings printed on especially good paper. The appropriateness of these illustrations shows that great care has been used in their selection. Altogether, it is an excellent piece of book-making, and will likely take rank with our best books on plant life.

#### **Annual Report of the Smithsonian Institution for 1902.** 659 pp. Illustrated. Washington, Government Printing Office, 1903.

This book is ever of interest to the reading world as the official and authentic record of scientific progress during the current year. In the present issue, following the business reports of the Executive Committee and the Board of Regents, a lengthy résumé of the activities of the year preceding June 30, 1902, in each of the numerous departments of the institution is given by Secretary S. P. Langley.

Of greatest interest, however, to those not professionally interested in the sciences will be found the very readable collection of papers illustrating the more remarkable and important developments in physical and biological discovery, which appear in the General Appendix of 542 pages. Among these memoirs more than passing attention will be drawn by an address delivered to the Aéronautical Society of Great Britain by its versatile president, Major Baden-Powell, on recent aéronautical progress and the deductions to be drawn therefrom.

The fascinating and little explored field of the radio-activity of matter is treated by Dr. Henri Becquerel, of the French Academy of Sciences.

Wireless telegraphy, the semblance to life functions displayed by certain classes of matter, and some recent discoveries in ethnology receive full attention.

A paper on the Nile Reservoir Dam at Assuân, by Thomas H. Means, of the Bureau of Soils, which appeared first in *FORESTRY AND IRRIGATION*, is reprinted by permission.

The Panama Route for a Ship-canal, Problems in Heredity, and a description of the valuable marine biological work done at Woods Hole, Mass., are among the subjects discussed which are more generally in the public mind.

In these days of marvelous achievement in discovery and invention, each new fact learned combines with those already known in constantly increasing ratio to clear the way for fresh triumphs. It is impossible for a man who does not read regularly and with discrimination to keep abreast of the progress of the times. Each year the Report of the Smithsonian Institution presents to him in condensed and not too technical form the nature and extent of scientific advance.

#### **Fourteenth Annual Report of the Missouri Botanical Garden.** Published by the Board of Trustees. St. Louis, Mo., 1903.

This work should make a valuable addition to a complete botanical library, since in addition to the formal report of the Board of Trustees, 230 of its pages are devoted to an exhaustive synopsis (with plates) of the genus *Lonicera*. The last general review of this genus was published more than 70 years ago. Since that time a number of the original 53 species have been referred to other genera or dropped, and nearly 80 species have been discovered, chiefly in Asia.

A Supplementary Catalogue of the Sturtevant Prelinnean Library is given at the end of



the report. This catalogue has become quite necessary, since extensive additions of works belonging to the period before 1753 have been added to the library within the past 7 years.

**The Nineteenth Annual Report of the Bureau of Animal Industry, Department of Agriculture, 1902.** 651 pp. Illustrated. Washington, Government Printing Office, 1903.

This volume contains the usual report of the Chief of the Bureau (D. E. Salmon) upon the extensive work of his various divisions during the year 1902.

The report proper is backed by nearly thirty papers of special interest to stock-feeders, dairy farmers, and butter-makers.

Stock-raisers and veterinarians will take interest in Dr. Salmon's account of the outbreak of the dreaded foot-and-mouth disease which appeared among cattle in Massachusetts and Rhode Island last November, and the measures which were taken by the Bureau to prevent it from spreading.

Of more particular interest to readers of **FORESTRY AND IRRIGATION** is an article on Sheep Ranching in the Western States, by E. V. Wilcox, Ph. D.

#### PUBLICATIONS RECENTLY RECEIVED.

Department of Agriculture, Bureau of Forestry, Bulletin No. 43. A Working Plan for Forest Lands in Hampton and Beaufort Counties, South Carolina. By Thomas H. Sherard, Field Assistant. 54 pp., map, diagrams, and illustrations. Government Printing Office, 1903.

Department of Agriculture, Office of Experiment Stations, Bulletin No. 134. Storage of Water on Cache la Poudre and Big Thompson Rivers. By C. E. Tait, Assistant in Irrigation Investigations. 100 pp., chart and illustrations. Government Printing Office, 1903.

Department of Agriculture, Office of Experiment Stations, Bulletin No. 133. Report of Irrigation Investigations for 1902, under direction of Elwood Mead, Chief of Irrigation Investigations. 258 pp., maps, diagrams, and illustrations. Washington: Government Printing Office, 1903.

Department of Agriculture, Bureau of Soils, Bulletin No. 22. The Chemistry of the Soil as Relates to Crop Production. By Milton Whitney (chief) and F. K. Cameron. 64 pp. Washington: Government Printing Office, 1903.

Department of Agriculture, Report No. 74. Progress of the Beet Sugar Industry in the United States in 1902. 221 pp. Illustrated. Washington: Government Printing Office, 1903.

Year Book and Record of the Seventh Annual Meeting, Buffalo, N. Y., July 7, 8, and 9, 1903. Vol. XII, part I.

By the American Park and Outdoor Art Association. 81 pp. Office of the Secretary, Rochester, N. Y., October 1, 1903.

(To be reviewed later.)

#### ADVERTISERS

FIND

### FORESTRY AND IRRIGATION A GOOD MEDIUM

## LAUGHLIN FOUNTAIN PEN

The Best at Any Price

Sent on approval to  
responsible people.

A Pocket Companion of  
never ending usefulness, a  
source of constant pleasure  
and comfort.

To test the merits of  
Forestry and Irrigation  
as an advertising medium  
we offer your choice of  
these popular styles super-  
ior to the

**\$3.00**

grades of other makes for  
only

**\$1.00**

Unconditionally Guaranteed  
Pre-eminently Satisfactory.

Try it a week, if not suited,  
we buy it back, and give you  
\$1.10 for it (the additional ten  
cents is to pay for your trouble  
in returning the pen). We are  
willing to take chances on you  
wanting to sell; we know pen  
values—you will when you  
have one of these.

Finest quality hard Para rubber  
reservoir holder, 14k. Diamond  
Point Gold Pen, any  
desired flexibility in fine, medium  
or stub, and the only perfect  
ink feed known to the science  
of fountain pen making.

Sent postpaid on receipt of \$1.00  
(Registration, 10 extra.)

This great Special Offer is  
good for just 30 days. One of  
our Safety Pocket Pen Holders  
free of charge with each pen.

Remember—There is No  
"just as good" as the Laughlin;  
insist on it; take no  
chances.

State whether Ladies' or  
Gentlemen's style is desired.  
Illustrations are full size of  
complete article. Address

LAUGHLIN MFG. Co.,

841 Griswold St.,

Detroit, Mich.

# Books on Nature and Outdoor Life

SENT POSTPAID ON RECEIPT OF PRICE

## NATURAL HISTORY.

Entomology for Beginners. Packard .....	\$1.75
Insects, Guide to Study of. Packard .....	5.00
Bird Neighbors. Blanchan .....	2.00
Camp Life in the Woods. Gibson .....	1.00
Batty's Taxidermy and Home Decoration .....	1.00
Names and Portraits of Birds. Trumbull .....	2.50
Taxidermy and Zoölogical Collecting. Hornaday .....	2.50
Taxidermy Without a Teacher. Manton .....	.50

## HUNTING.

Art of Shooting. Lancaster. Popular edition .....	1.25
Field, Cover, and Trap Shooting. Bogardus. New edition .....	2.00
Hints and Points for Sportsmen .....	1.50
Hitting vs. Missing. Hammond .....	1.00
Modern Shotguns. Greener .....	1.00

## FISHING, ETC.

Black Bass, A Book of the. Henshall .....	3.00
Black Bass, More About the. Henshall .....	1.50
Home Fishing in Home Waters. Green .....	.50
Fishes, American. Goode .....	3.50
Superior Fishing; or, the Striped Bass, Trout, Black Bass, and Bluefish of the Northern States. Roosevelt .....	1.50
Trout, Domesticated. Stone, Livingston .....	2.50
American Fishes. Large 4to. Goode. Illustrated .....	3.50
Angling on Salt Water .....	.50
Favorite Flies and How to Tie Them .....	5.00
Fishing with the Fly. Orvis-Cheney Collection .....	2.50
Fly-Fishing and Fly-Making for Trout .....	1.50
Men I Have Fished with. Mather .....	2.00
With Fly-Rod and Camera. Samuels. 147 plates .....	5.00

## BOATING.

Boat Building and Sailing. Neison and Kemp .....	\$3.00
Canoe and Camp Cookery. "Seneca" .....	1.00
Canoe and Boat Building for Amateurs. Stephens .....	2.00
Canoe Handling and Sailing. Vaux .....	1.00
Canvas Canoes; How to Build Them. Field .....	.50
Cruises in Small Yachts and Big Canoes. Speed .....	2.50
Frazar's Practical Boat Sailing. ...	1.00
Model Yachts. 118 designs and working diagrams. Grosvenor .....	2.00
Practical Boat Sailing. Davies .....	2.00
Practical Boat Building. Neison .....	1.00
Sails and Sailmaking. Kipping .....	1.25
Steam Yachts and Launches. Kunhardt .....	3.00
Yachtsman's Handy Book .....	1.50

## HORSES AND DOGS.

American Horses and Horse Breeding. Dimop .....	350
Bridle Bits, The. Illustrated. Battersby .....	1.00
Horse, How to Judge. Beach .....	1.00
Horse, The, How to Buy and Sell. Howden .....	1.00
Horse, The. Youatt and Spooner .....	1.00
Horse Book, American Reformed. 8vo. Dadd .....	2.00
Horse, The Family. Martin .....	1.00
Horse, Training the Trotting. Martin .....	3.50
Saddle Horse, The, Complete Guide to Riding or Training .....	1.00
Trotting Horse in America, The. Woodruff .....	1.00
Veterinary Adviser, Farmers'. 12mo. Law .....	3.00
Dog Training. Hammond .....	1.00
Dog Training, Principles of "Ashmont" Percy .....	.50
Dogs of Great Britain, America, and Other Countries, Compiled from Stonehenge and other standard writers .....	1.50

## CAMPING AND TRAPPING.

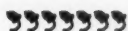
Gipsy Tents and How to Use Them .....	1.25
Log Cabins and How to Build Them .....	1.50
Trappers' Guide. Newhouse .....	1.00
Woodcraft. "Nessmuk" .....	1.00

If readers desire books not on the above list let us know what they are, and we will send them at regular retail price, postpaid. Address

**FORESTRY AND IRRIGATION, Atlantic Building, Washington, D. C.**

In writing advertisers kindly mention FORESTRY AND IRRIGATION.

# LET US BE YOUR BOOK BUYERS



**I**N our plan of serving the readers of **FORESTRY AND IRRIGATION** we have found so many who have taken advantage of our former offer to furnish books on forestry and irrigation subjects that we are broadening the scope of our book department so as to furnish any book a reader may want.

These books are furnished at publishers' list prices, and will be sent postpaid on receipt of price. We save you postage and express charges.

## FORESTRY

Flora of the Northern U. S. and Canada, Britton and Brown (3 vols.).....	\$9.00
Our Native Trees, Harriet L. Keeler.....	2.00
North American Forests and Forestry, Ernest Bruncken.....	2.00
The Adirondack Spruce, Gifford Pinchot.....	1.00
Forest Trees and Forest Scenery, G. Frederick Schwarz.....	1.50
West-American Cone-bearers, J. G. Lemmon.....	1.00
How to Tell the Trees, J. G. Lemmon.....	.50
Flora of the Southern States, A. W. Chapman.....	4.00
Trees of the Northern United States, E. A. Apgar.....	1.00
Our National Parks, John Muir.....	1.75
Trees of New England, Dame & Brooks.....	1.50
Studies of Trees in Winter, Annie Oakes Huntingdon ..	2.25
Manual of Botany, Asa Gray.....	1.62
Practical Forestry, Fuller.....	1.50
Forest Planting, Jarchow.....	1.50
The White Pine, Gifford Pinchot.....	1.00
American Woods, Romeyn B. Hough (in nine parts), per part.....	5.00
Practical Forestry, John Gifford.....	1.20
A First Book of Forestry, Filibert Roth.....	1.25
Among Green Trees, Julia Ellen Rogers.....	3.00
Economics of Forestry, B. E. Fernow.....	1.50
Principal Species of Wood, Charles H. Snow.....	3.50
Principles of American Forestry, S. O. Green.....	1.50

## IRRIGATION

Irrigation in the United States, F. H. Newell.....	\$2.00
Irrigation Engineering, Herbert M. Wilson.....	4.00
Irrigation and Drainage, F. H. King.....	1.50
Irrigation for Farm and Garden, Stewart.....	1.00
Irrigating the Farm, Wilcox.....	2.00
Practical Farm Drainage, Charles G. Elliott.....	1.00

If readers desire books not on the above list let us know what they are, and we will send them at regular retail price, postpaid. Address

**Forestry and Irrigation**  
Atlantic Building      Washington, D. C.

In writing advertisers kindly mention **FORESTRY AND IRRIGATION**.

## **VERY LOW RATES to the Northwest**

The Northern Pacific has a new and very **Low Rate** for Colonists, Homeseekers, and others in effect from Sept. 15 to Nov. 30, 1903.

This gives not only farmers a good chance to go homeseeking, after crops are harvested, but all others who wish to move permanently into the growing, teeming, improving Northwest; or those who wish to visit, at a trifling expense, the fine tourist resorts of the Northwest, are afforded an unusual opportunity to do so.

The finest valleys in the Northwest, good for grain, hay, fruits, root crops; for mixed stock or dairy farming; for irrigation or not, as one wishes, are found along the Northern Pacific or its branch or connecting lines. The growing, thriving towns are found there, too. It is a great country, where hunting and fishing are unsurpassed and where the hotels are first class.

Call on any N. P. R. agent for rates and detailed information or write to CHAS. S. FEE, General Passenger Agent, St. Paul, Minn.

Send six cents for "Wonderland 1903."

## **California for \$33**

**From Chicago. Low rates  
from East generally.**

Daily, to November 30.  
Through tourist sleepers and  
Harvey meals  
Homeseekers traverse by this line  
the rich San Joaquin Valley.

"Santa Fe all the way," Chicago and  
Kansas City to Los Angeles, San Diego  
and San Francisco.

Interesting pamphlets free—  
telling about cheap lands in California.

Geo. C. Dillard, Gen. Agent  
The Atchison, Topeka & Santa Fe Railway  
377 Broadway, New York

## **Santa Fe**



**The Underwood Typewriter**

### **Don't Write in the Dark**

The Underwood has every advantage that can be offered by any other machine, besides writing in Broad Daylight. It is the strongest and best machine made.

UNDERWOOD TYPEWRITER CO.  
1206 "F" St. N. W. Washington, D. C.

In writing advertisers kindly mention FORESTRY AND IRRIGATION

# A List of Important Books on Nature Study

## Long's Wood folk Series

	<i>List Price</i>
Ways of Wood Folk . . . . .	\$0.50
Wilderness Ways . . . . .	.45
Secrets of the Woods . . . . .	.50
Wood Folk at School . . . . .	.50

## Hodge's Nature Study and Life

List price, \$1.50

The most scholarly, practical, and exhaustive work on nature study now published.

	<i>List Price</i>
Atkinson's First Studies of Plant Life . . . . .	\$0.60
Comstock's Ways of the Six-Footed . . . . .	.40
Roth's First Book of Forestry . . . . .	.75
Burt's Little Nature Studies for Little People:	
From the Essays of John Burroughs, Vols. I and II, each . . . . .	.25
Eddy's Friends and Helpers . . . . .	.60
Gould's Mother Nature's Children . . . . .	.60
The Jane Andrews Books:	
Seven Little Sisters . . . . .	.50
Each and All . . . . .	.50
Stories Mother Nature Told Her Children . . . . .	.50
Stories of My Four Friends . . . . .	.40
Jefferies' Sir Bevis (from "Wood Magic") . . . . .	.30
Morley's Few Familiar Flowers . . . . .	.60
Flowers and their Friends . . . . .	.50
Little Wanderers . . . . .	.30
Seed-Babies . . . . .	.25
Insect Folk . . . . .	.45
Newell's Reader in Botany:	
Part I. From Seed to Leaf . . . . .	.60
Part II. Flower and Fruit . . . . .	.60
Porter's Stars in Song and Legend . . . . .	.50
Stickney's Study and Story Nature Readers:	
Earth and Sky. Book I . . . . .	.30
Earth and Sky. Book II . . . . .	.30
Pets and Companions . . . . .	.30
Bird World . . . . .	.60
Strong's All the Year Round Series: (Spring, Autumn, Winter), each . . . . .	.30

FOR SALE BY

## FORESTRY and IRRIGATION

Atlantic Building

Washington, D. C.

In writing advertisers kindly mention FORESTRY AND IRRIGATION,



# REAL ESTATE

**FORESTRY AND IRRIGATION** conducts a real estate department, the services of which are offered to all readers of this magazine. It will endeavor, through judicious advertising and correspondence, to buy and sell property of every kind. In other words, this department will act as an agent in any transactions our readers may have involving real estate. For this service there will be no charge unless a sale is concluded, when the usual commission will be expected.

To all interested we would say that it costs no more than the postage from your end to make known your wants—either to acquire or dispose of property.

We desire to impress our patrons with the fact that this magazine guarantees honest treatment. The Real Estate department is managed by competent and experienced men who will devote their best efforts toward building up a national business and a national reputation for fair dealing. We call particular attention to the fact that no property will be listed on our books that will not bear out under the closest investigation everything that is claimed in its behalf. While we wish to handle small properties and will give them careful attention, we propose to make a speciality of large properties and enterprises, as we have exceptional opportunities for reaching capital seeking paying investments, especially in the West and South. The character of investments which seem to be most in demand are manufacturing sites, farming, grazing, and timber lands. We also have inquiries relative to orange groves both in Florida and California.

## PROPERTIES FOR SALE

### DISTRICT OF COLUMBIA

We make a speciality of Washington City real estate and investments, and are prepared to furnish any information desired to those looking to an investment, or toward a temporary or permanent residence.

### ALABAMA

**TIMBER—TUPELO GUM, OAK, ASH, AND POPLAR.**—7,000 acres, heavily timbered, on lakes and river front; 65 miles to Mobile by river. \$5 50 per acre for timber; 10 years to remove. Will cut 5,000 feet of gum per acre, and 3,000 feet of oak, guaranteed to bring \$25 per 1,000, firsts and seconds; common \$17, and culls \$12 per 1,000, on local market. Conveniently situated for direct shipment to European market.

### ARKANSAS

**MANGANESE ORE LANDS.**—800 acres, half mile from R. R., analyzing 50 % metallic ore. Estimated to yield 800,000 tons at cost not to exceed \$2 per ton, f. o. b. Fine investment. Particulars on application.

### CALIFORNIA

**ORANGE RANCH IN FULL BEARING.**—46 acres farm, with citrus and deciduous fruits, in the best fruit belt of California. Home and outbuildings, with abundant water for irrigation and domestic use. Ready market for all crops. Will pay more than 15 per cent. on purchase price, which is only \$3,000.

### FLORIDA

The following tracts of Longleaf Pine and Cypress lands—on or near the west coast of Florida:

- (1) 64,000 acres; average cut, 2,000 feet of pine to the acre. These lands lie in the noted lemon, orange, and vegetable belt of the state, and have transportation facilities by both rail and water.
- (2) 110,000 acres; this land will cut on an average of from 1,500 to 2,000 feet per acre of pine, and is also located in the best citrus fruit belt of the state.
- (3) 247,000 acres; virgin forest, cutting on the average of 5,000 feet per acre, based on a very conservative estimate. About one-fifth cypress and four-fifths pine. Maximum cut of pine 18,000 feet, and of cypress 50,000 feet per acre. Transportation facilities good.
- (4) 390,000 acres, located on a navigable river, with transportation to the Gulf of Mexico. This tract contains a large area of valuable cypress. The cut will average from 2,000 to 3,000 feet per acre of cypress and pine. This land, aside from the value of its timber, is also one of the finest cattle ranges in the state.
- (5) 230,000 acres; this tract has about the same characteristics as tract (4).
- (6) 110,000 acres; estimated cut of timber is 1,500 feet per acre. This tract is within

In writing advertisers kindly mention **FORESTRY AND IRRIGATION**

## FLORIDA—Continued

the citrus fruit belt of the state and will be valuable for either colonization or cattle-raising after the timber is cut. A new railroad is being built through this tract.

(7) 90,000 acres; this tract contains 70,000 acres of Longleaf Pine and 20,000 acres of Cypress. The timber is estimated to cut from 2,000 to 3,000 feet per acre. A large sawmill costing \$40,000 is located on this land and is included in the sale of the land and timber. This mill is located on a river to which a great deal of this tract is contiguous.

(8) 130,000 acres. This tract adjoins tract 8 and will cut not less than 3,000 feet of Longleaf Pine to the acre.

(9) 12,000 acres of fine grazing land.

(10) 30,000 acres of fine grazing land, being one of the best cattle ranches in the state.

All necessary particulars will be given on application. Terms cash. Land will be sold either in bulk or in the separate tracts above set forth.

## GEORGIA

**FOR SALE.**—7,900 acres of land in southeast Georgia. Pine and Cypress timber. On railroad. Cheap to quick purchaser.

## IOWA

**VALUABLE FRUIT FARM.**—Orchard of 7 acres in full bearing, assorted fruits, with 10-room house and buildings. Rockford, Iowa. Private and city water. Fine local market. Only \$4,500.

## LOUISIANA

**UNUSUAL MILLING OPPORTUNITY.**—Virgin forest of Louisiana red cypress, estimated to cut 50,000,000 feet; on water-course and railroad; exceptional situation; probably the only considerable quantity of red cypress in the United States today; for sale at bargain. To quick purchaser, **\$3.50 per 1,000.**

**RED RIVER PLANTATION.**—1,605 acres; on railroad; has 2 miles river front; richest soil in state; 800 acres in cultivation, 800 in timber—cypress and oak; timber alone a paying investment; 1 to 1½ bales cotton per acre; 60 bu. corn, 8 tons alfalfa. Improvements—new steam gin plant and press, cost \$5,000; store building, large residence, 32 tenant houses, barn, and outbuildings. **Only 48,000, \$10,000 down and balance in easy payments.**

**FIRST CLASS FARM.**—750 acres near Shreveport, La., De Soto Parish; grows cotton, corn, tobacco, and fruit; would make ideal stock farm. **Cheap at \$3,550.**

**GOOD INVESTMENTS.**—Several tracts on main line of railroads to Cincinnati and St. Louis, \$2.50 to \$5 per acre. Good fruit country, and when planted in fruit trees sells readily for \$25 per acre. Write for particulars.

**15 PER CENT INVESTMENT.**—Plantation contiguous to Mississippi River, one mile from steamboat landing. 1,320 acres alluvial land, with improvements consisting of good dwelling, cotton gin, new engine, and boiler. One large store is rented for \$30 per month. Agricultural implements go with place, and stock will be sold at reduced price to purchaser. 1,120 acres in cultivation, producing excellent cotton. **Only \$45,000; one-half cash, balance in 1 and 2 years.**

**HARDWOOD TIMBER LAND.**—175,000 acres alluvial land will be sold in parcels to suit purchaser at from \$5 to \$12 per acre. Can sell 100,000 acres in solid body. All soil is rich, and difference in price depends wholly on value of timber standing, which will cut from 3,000 to 6,000 feet per acre. To home-seekers, small tracts at \$10 per acre, \$1.50 down and balance in 3 and 5 years. Rice, sugar cane, cotton, and alfalfa are not grown to better advantage anywhere else in the state.

## MARYLAND AND VIRGINIA

The location of these two states, their fertility, and market and transportation facilities, as well as their temperate and healthful climate, make them an ideal part of the United States for residence or as profitable fields for investment. Persons living in the northern states are taking advantage of these conditions. We have a number of farms, from 40 to 1,000 acres in extent, for sale in both of these states; also residences in the pretty suburban towns just outside of Washington.

**FOR SALE.**—An excellent farm in Fauquier county, Virginia, 3 miles from Warrenton, and only ½ mile from railroad at Meetze Station, with post-office, store, freight depot, etc. Property consists of 147 acres rolling land, with good barn; fences, and outbuildings; 75 acres under cultivation; 15-acre woodlot, with good timber. Running stream through farm, and several springs. Climate good. Would make an ideal summer resort, and is in the best fox-hunting section of the state. **Price, only \$2,500.**

In writing advertisers kindly mention **FORESTRY AND IRRIGATION**

## MARYLAND AND VIRGINIA—Continued

**OLD VIRGINIA ESTATE**.—Rare bargain near Warrenton, 30 miles from Washington; 418 acres good agricultural or stock land, well fenced and watered. Blue grass belt, neighborhood of wealthy and exclusive Virginia families. Improvements—15 room mansion, 2 large barns, 2 tenant houses, outbuildings. Bargain at **\$12,000**.

**IN THE FAMOUS SHENANDOAH VALLEY**.—120 acres, fine orchard, running stream through farm; 3 miles from Berryville, ½ mile from railroad station. Modern house and necessary outbuildings. Good water-power mill-site. Complete as it stands, 24 head of cattle, horses, pigs, chickens, etc., \$12,800. As land alone sells for \$100 per acre in this neighborhood, improvements and stock are practically free.

**A HOME IN THE MOUNTAINS**.—Well built, airy house, modern construction, with outbuildings, kitchen, and flower gardens, lawn, tennis court, etc.; 25 minutes' drive from Greenbriar White Sulphur Springs; surrounded by beautiful scenery. High, cool, and healthful. 100 acres, whole or in part, will be sold with the house and grounds, with additional cleared and forest lands up to 1,000 acres if desired. The home will be sold for **\$3,500**, or less than half of its cost, with utensils and furnishings, complete and ready for occupancy. Roads, fences, gates, and drainage in excellent order. An unparalleled chance for country home.

## MINNESOTA

**SAWMILL PROPERTY**.—Saw, lath, and shingle mill, 70 h. p., in virgin forest of pine, spruce, balsam, tamarack, cedar, and poplar; on railroad. Dwelling house and outbuildings, with 160 acres uncut timber. Opportunity for good manager, at **\$6,000**. 1,500 acres adjoining timber land also for sale.

**FINE HOTEL PROPERTY**.—32-room hotel and outbuildings, in perfect repair; gas and electric lights; a. m. i.; 30 regular boarders besides transients. At Winona, Minn. Owner's death necessitates sale. **\$13,000**.

## MISSISSIPPI

**WATER POWER AT A GREAT BARGAIN**.—\$3,900 buys a splendid water power in southern cotton belt, developing 600 h. p. or over; perpendicular fall of 70 feet. 320 acres go with property. Only 12 miles from Meridian, Miss., a growing town of 20,000 population, to which electric power can be transmitted with only 10 per cent loss. Property cheap at **\$10,000**.

**LONG LEAF YELLOW PINE**.—18,000 acres, estimated to contain 100,000,000 feet, on railroad near Mobile, Ala. Planing and sawmill plant, with daily capacity of 25,000 feet; also dry-kiln. Big profits to man with capital and experience. Particulars and price on application. Also 10,000 acres timber land, same locality and character.

**WILL PAY FOR ITSELF**.—560 acres, near Ackerman, Miss., on railroad, with fencing and other improvements; 175 acres in cultivation, 285 in timber, market for which is already assured. Enterprising man could make land pay for itself in first year. Price, **\$5,600**.

**COLONIAL HOME**.—"The Oaks," magnificent estate near Jackson, Miss. 913 acres good soil in high state of cultivation; improved by finest country residence in central Mississippi; cost \$16,000 to build. Barns, stock sheds, and outbuildings. Only **\$20,000** to immediate purchaser.

**VIRGIN FOREST**.—11,000 acres hardwood timber on railroad in Yazoo county; a paying investment at **\$11 per acre**.

**TIMBER LANDS**.—1,080 acres valuable timber land on Southern R. R. and water-course, at Sapa; **\$4 per acre**. Also 480 acres virgin hardwood, white oak, hickory, and gum, near Jackson; **\$12.50 per acre**.

## NEW YORK

**FOR SALE**.—About 690 acres of unimproved land in the central part of Long Island (Suffolk county, N. Y.), within 60 miles of New York City, and 2½ miles from railway station, on the Long Island Railway.

Part of an old estate, and has never been under cultivation. Adjoining tracts have made excellent farming land. Soil is sandy, drainage good; no swampy land; well wooded, chiefly with pine. As the property stands it would make a good game preserve, or could be made productive by suitable foresting.

Price, **\$10 per acre**. An excellent investment for one who would develop the property, as it would double in value in a few years.

**HANDSOME ESTATE**.—Estate known as the "Uplands," near Glen Cove, L. I.; 100 feet above water; fine view of Hempstead harbor; 45 acres handsomely improved property, in lawns, drives, gardens, and orchard; complete water system. Magnificent 3 story dwelling, luxuriously finished, 24 rooms, hot and cold water throughout; stable and carriage house, greenhouse, gardener's and coachman's cottages, etc. **\$100,000**. Other property in same locality for sale.

In writing advertisers kindly mention **FORESTRY AND IRRIGATION**

## NEW YORK—Continued

**A PAYING HOTEL**—A well-known hotel property in the Adirondacks; includes good sized hotel and furnishings, horses, carriages, boats; 1,200 acres of mountain land, with two small lakes well stocked with trout. A great bargain at \$25,000.

## TENNESSEE

**SLATE QUARRY**.—Fine quarry, easily and inexpensively mined, with water transportation and on line of proposed railroad. Worked profitably for 18 months, with orders for 2 years in advance. Slate outcrops from 50 to 150 feet above ground, first quality and inexhaustible. 2,300 acres in this property, which will cut 5,000 feet of hardwood per acre. Will sell outright at fraction of value, or arrange for capital to finance and properly exploit mines. Unrivalled opportunity for investment. Address this department for further particulars.

**COAL LAND**.—3,000 acres Jellico coal land on main line of C. N. O. & T. R. R. in Kentucky, near Tennessee line. Mines are now paying net profit of \$1 per ton to owner, and will pay more. Further particulars on application.

## WEST VIRGINIA

**LIME AND CEMENT**.—472 acres, containing coal, lime, and cement stone. Limestone 400 feet thick, cement rock 35 feet thick, and coal 4 to 5 feet thick. Plenty of timber on property. Plant ready for operation with modern machinery; railroad sidings on premises. For further details apply to this department.

**SPECIAL, 20,000 ACRES OF TIMBER**.—Spruce and hemlock; one-half will cut 20,000 feet to the acre, balance 12,000 feet. Modern sawmill, daily capacity 50,000 feet; planer, docks, trams, etc.; 10 miles standard gauge railroad, with engine, cars, steam loader, and skidder; 8 miles additional graded, with ties and rails on ground ready to lay. Storehouse, dwellings; in short, a modern lumber plant in daily operation on railroad, with good connections east and west. Apply for further particulars.

**COAL LANDS**.—10,000 acres coal lands, convenient to railroads; three veins, one 4½ feet thick, and without slate. Cheap. Send for particulars.

**TIMBER INVESTMENTS**.—8,000 acres spruce and hemlock, on railroad; will cut 20,000 feet per acre. \$35 per acre.

1,500 acres spruce and hemlock, 2 miles from railroad; will cut 25,000 feet per acre. \$37 per acre.

54,000,000 feet fine timber, on tract of 5,500 acres on Greenbrier River and C. & O. R. R.; will cut 20,000,000 hemlock, 10,000,000 white oak, 7,000,000 red oak, 8,000,000 chestnut oak, 1,000,000 white pine, and 8,000,000 poplar, birch, chestnut, linden, hickory, locust, etc. Profits on tan bark alone will pay for the land. \$18 per acre.

We have many other valuable mineral and timber properties in this state on our books. Particulars on application.

**COAL, IRON, OIL, AND TIMBER LANDS**.—7,000 acres on main line Norfolk and Western. Coal developed already; timber worth \$88,000; complete prospectus furnished.

## WASHINGTON

**IRRIGATED FRUIT FARM**.—5,000 acres in fruit, vegetables, and alfalfa, in Spokane Valley, on Northern Pacific. Small tracts at \$100 an acre.

## WYOMING

**FOR SALE**.—Wyoming cattle ranch, near Saratoga, in the valley of the North Platte, 1,880 acres deeded land, irrigated and producing crops; 3,000 acres state leased lands adjoining; 25 miles fencing. Finest summer range in the foothills of the mountains, where stock prosper and grow. Plenty of shade, grass, and pure running streams of water. Fine ranch buildings. Modern 9-room log house, corrals, stable, shop, with water-power for grinding sickles. Priority water rights. Good neighbors, school, and church. Will sell low, or will rent to capable party for term of years. Profitably operated for 17 years. Stocked with Hereford cattle. Price, \$30,000.

Address:

**LEE M. LIPSCOMB, Manager,**  
Real Estate Department . . . Forestry and Irrigation  
Washington, D. C.

In writing advertisers kindly mention FORESTRY AND IRRIGATION

## Seed and Seedlings

**THOMAS MEEHAN & SONS, Inc.**

## Tree Seedsmen

**DRESHER TOWN.**

PENNA.

that sell nursery stock from the famous

whose stock is better adapted to all localities than any others. Agents wanted in every county. Write at once for terms and territory, giving reference.

**Grafted Pecans, Walnuts, Chestnuts and  
Seedling Nut Trees of all kinds.**

Send four cents for our descriptive catalogue  
and price list.

NASHVILLE, TENN.

**We are the largest Orchid growers in the United States : : : : : : : : :**

Our illustrated and descriptive Catalogue  
of Orchids is now ready and may be had  
on application : : : : : : : : : :

### Orchid Growers and Importers...

LAGER & HURRELL  
SUMMIT, N. J. : : : : :

**For Sportsmen, Campers, Etc.**

**Holds as Much as a Trunk  
Weight, 3½ Pounds  
A Valise on the Cars  
A Pack-Bag in the Woods  
Send for Circular "D"**

**J. KINSTLER, 126 Oak St., Chicago, Ill.**



**GUARDED**

**WILL INTEREST YOU**

Send for circular describing it, together with numerous conveniences for campers and hunters.

**MARBLE SAFETY AXE CO.**  
GLADSTONE, MICH., U. S. A.

The . . **PAPER** . . that this publication is printed  
on is furnished by

## R. P. Andrews & Company (Inc.), Washington

Sole Agents in the District of Columbia for the  
**West Virginia Pulp and Paper Company**  
the Largest Manufacturers of Book Paper in  
the world.

## IF IN NEED, DROP THEM A LINE

In writing advertisers kindly mention FORESTRY AND IRRIGATION



## KILNS AND APPARATUS

TO COLLECT

WOOD ALCOHOL  
ACETIC ACID ❖❖  
WOOD OIL ❖❖❖❖  
TURPENTINE ❖❖

FROM THE SMOKE OF WOOD  
AND MAKING 45 TO 50 BUSHELS  
OF SUPERIOR

## CHARCOAL

PER CORD OF WOOD

PLANNED BY

J.A. MATHIEU, Georgetown, S.C.

## Catalpa Trees

SEEDLINGS IN LARGE NUMBERS

Twenty years' experience in growing this valuable timber. Excellent for posts, poles, ties, and lumber.

CONTRACTS taken for plantations of not less than 60 acres. A ten-year-old Catalpa grove is a gilt-edged investment.

GEO. W. TINCHER  
WILSEY, KANS.

READ

## Irrigation in the United States

By FREDERICK HAYNES NEWELL

Chief Engineer U. S. Reclamation Survey.

The book of authority on the most logical expansion question before our people.

Price \$2.00, postpaid to any address.

Address: FORESTRY AND IRRIGATION  
Washington, D. C.

## NUT TREES

(Japan Walnuts)

4 Sieboldii, 4 Cordiformis .....\$1.00

4 Japan Chestnuts, 4 Spanish Chestnuts .....\$1.00

4 Pecans, 4 Butternuts .....\$1.00

4 Mandschurica Japan Walnuts (new). .....\$1.00

4 English Walnuts, 4 Black Walnuts.\$1.00

All one year, 4 to 6 inches high.

The above 36 trees for \$4.50

By mail (postage paid). Send for Catalogue.

OAK LAWN NURSERY

A. W. NEWSON, Mgr. Huntsville, Ala.

## COMPLETE FILES OF

## FORESTRY AND IRRIGATION

### FOR 1902

A limited number of complete volumes (unbound) of this magazine for the past year may be obtained from the publisher at \$1.50 per volume.

Address

FORESTRY AND IRRIGATION

Atlantic Building

Washington, D. C.



In writing advertisers kindly mention FORESTRY AND IRRIGATION

ORGANIZED APRIL, 1882.

INCORPORATED JANUARY, 1897.

# THE American Forestry Association

## OFFICERS FOR 1903.

### President.

HON. JAMES WILSON, Secretary of Agriculture.

### First Vice-President.

DR. B. E. FERNOW, Ithaca, N. Y.

### Secretary.

EDWARD A. BOWERS, New Haven, Conn.

*Treasurer*, OTTO LUEBKERT, Washington, D. C.

### Directors.

JAMES WILSON.  
B. E. FERNOW.

HENRY S. GRAVES.  
HENRY GANNETT.

EDWARD A. BOWERS.  
OTTO LUEBKERT.

FREDERICK V. COVILLE.  
F. H. NEWELL.

FILIBERT ROTH.

GIFFORD PINCHOT.

GEORGE P. WHITTLESBY.

### Vice-Presidents.

SIR H. G. JOLY DE LOTBINIÈRE, Victoria, B. C.  
CHARLES C. GEORGESEN, Sitka, Alaska.  
D. M. RIORDAN, Flagstaff, Ariz.  
THOMAS MCRAB, Prescott, Ark.  
WM. R. DUDLEY, Stanford University, Cal.  
HENRY MICHELSEN, Denver, Col.  
ARTHUR T. HADLEY, New Haven, Conn.  
WM. M. CANBY, Wilmington, Del.  
A. V. CLUBBS, Pensacola, Fla.  
R. B. REPPARD, Savannah, Ga.  
CHAS. DEERING, Chicago, Ill.  
JAMES TROOP, Lafayette, Ind.  
THOMAS H. MACBRIDE, Iowa City, Iowa.  
L. W. YAGGY, Hutchinson, Kansas.  
S. C. MASON, Berea, Ky.  
LEWIS JOHNSON, New Orleans, La.  
EDWARD L. MELLUS, Baltimore, Md.  
JOHN E. HOBBS, North Berwick, Me.  
N. S. SHALER, Cambridge, Mass.  
CHARLES W. GARFIELD, Lansing, Mich.  
SAMUEL B. GREEN, St. Anthony Park, Minn.  
WILLIAM TRELEASE, St. Louis, Mo.  
CHARLES E. BESSY, Lincoln, Neb.  
JOHN GIFFORD, Princeton, N. J.

EDWARD F. HOBART, Santa Fe, N. M.  
W. A. WADSWORTH, Geneseo, N. Y.  
C. A. SCHENCK, Biltmore, N. C.  
FRANK WHITE, Bismarck, N. D.  
WM. R. LAZENBY, Columbus, Ohio.  
A. C. SCOTT, Stillwater, Okla.  
J. T. ROTHROCK, West Chester, Pa.  
H. G. RUSSELL, E. Greenwich, R. I.  
N. E. HANSEN, Brookings, S. D.  
THOMAS T. WRIGHT, Nashville, Tenn.  
WM. L. BRAY, Austin, Texas.  
E. F. HOLMES, Ogden, Utah.  
FRANK W. ROLLINS, Concord, N. H.  
REDFIELD PROCTOR, Proctor, Vt.  
D. O. NOURSE, Blacksburg, Va.  
ADDISON G. FOSTER, Tacoma, Wash.  
A. D. HOPKINS, Morgantown, W. Va.  
THOMAS F. WALSH, Washington, D. C.  
JOS. M. CAREY, Cheyenne, Wyo.  
ELIHU STEWART, Ottawa, Ont.  
WM. LITTLE, Montreal, Quebec.  
GEO. P. AHERN, Manila, P. I.  
WM. R. CASTLE, Hawaii.  
J. H. MCLEARY, San Juan, P. R.

Annual Dues, \$2.00. Life Membership, with exemption from further dues, \$100.00.

Sustaining Membership, \$25.00 a year.

FORESTRY AND IRRIGATION is the official organ of the Association, and is sent regularly to all members.

## APPLICATION FOR MEMBERSHIP.

To the Assistant Secretary,

AMERICAN FORESTRY ASSOCIATION,  
WASHINGTON, D. C.

DEAR SIR: I hereby signify my desire to become a member of the American Forestry Association. Two dollars (\$2.00) for annual dues enclosed herewith.

Very truly yours,

Name.....

P. O. Address.....

## THE Great American Desert

Is already a thing  
energy and persist-  
can Farmer, his  
methods of cultiva-  
gressive spirit that  
search for such food  
ed to our western  
bined to make the

west of the one-hundredth meridian as abiding as the stars.  
In no part of the great west has this triumph been of more  
colossal proportion than in Kansas and Nebraska.

Where once stretched plains almost devoid of vege-  
tation now can be seen broad, fertile fields with  
the sun shining on wheat fields all gold,  
corn waving its broad leaves  
of green, and the royal  
purple of alfalfa.

### FOR INFORMATION

*about the states of Nebraska, Kansas  
or that vast region traversed by the  
Union Pacific, drop a letter or postal  
card to*

**E. L. LOMAX, G. P. & T. A.**  
OMAHA, NEB.



of the past. The  
ence of the Ameri-  
study of improved  
tion, and his pro-  
has caused him to  
plants as are adapt-  
states, have all com-  
triumph over nature

**50 YEARS' EXPERIENCE**

# PATENTS

**TRADE MARKS  
DESIGNS  
COPYRIGHTS &C.**

Anyone sending a sketch and description may  
quickly ascertain our opinion free whether an  
invention is probably patentable. Communica-  
tions strictly confidential. Handbook on Patents  
sent free. Oldest agency for securing patents.  
Patents taken through Munn & Co. receive  
special notice, without charge, in the

**Scientific American.**

A handsomely illustrated weekly. Largest cir-  
culation of any scientific journal. Terms, \$3 a  
year: four months, \$1. Sold by all newsdealers.

**MUNN & Co. 361 Broadway, New York**  
Branch Office, 625 F St., Washington, D. C.

# R·I·P·A·N·S

**R·I·P·A·N·S Tabules**  
**Doctors find**  
**A good prescription**  
**For mankind.**

The 5-cent packet is enough for  
an ordinary occasion. The  
family bottle (price 60 cents)  
contains a supply for a year.

In writing advertisers kindly mention FORESTRY AND IRRIGATION.

# Thorburn's Bulbs

## FOR FALL PLANTING

OUR DESCRIPTIVE CATALOGUE is now ready, and will be mailed free on application. It is beautifully illustrated, and contains full cultural directions, and a most complete collection of all the newest and best sorts—

**Hyacinths, Tulips, Daffodils,  
Lilies, Crocuses, Irises,**

including a magnificent collection of the newest and most beautiful varieties of the Japanese Iris,

**Freesias, Lily-of-the Valley, etc., etc.**

### SEND FOR CATALOGUE

We are the Largest and Oldest BULB IMPORTERS in America.

**J. M. THORBURN & CO.**

**36 Cortlandt Street, New York**

ESTABLISHED 1802

## Biltmore Forest School

Biltmore, N. C.



Theoretical and practical instruction in all branches of applied forestry.

Course comprising twelve consecutive months can be entered at any time of the year—no vacations.

Object lessons within the mountain estate of George W. Vanderbilt, comprising 120,000 acres, where forestry has been practiced since 1895.



For further information apply to

**C. A. Schenck, Director**

## YALE FOREST SCHOOL NEW HAVEN, . . . CONNECTICUT

The course of study in THE YALE FOREST SCHOOL covers a period of two years. Graduates of collegiate institutions of high standing will be admitted without examination, provided they can show the requisite knowledge of Botany, Geology, and Inorganic Chemistry.

The Summer School of Forestry is conducted at Milford, Pike County, Penna. The session in 1904 will open July 1st and continue seven weeks

For further information address

**Henry S. Graves, Director, New Haven, Conn.**

